





INDIAN AGRICULTURAL  
RESEARCH INSTITUTE, NEW DELHI.

**I. A. R. I. 6.**

MGIPC—SI—6 AR/54—7-7-54—10,000.





# AMERICAN MUSEUM NOVITATES

Number 721 <sup>763</sup> THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

May 4, 1934

59.31, 2 (26.9)

## FORAMINIFERA FROM THE ROSS SEA

By A. S. WARTHIN, JR.<sup>1</sup>

### INTRODUCTION

The bottom mud from a 1680 foot sounding in the Bay of Whales, Ross Sea (lat. 78° 34' S., long. 163° 48' W.) was collected for the author by Dr. L. M. Gould, geologist of the first Byrd Antarctic Expedition. This location marks the most southerly point at which Foraminifera have been collected, and is the only station of its kind in the eastern two-thirds of the Ross Sea. It is about ninety miles from the nearest known land.

The sample consisted of about 200 cc. of gray mud, which left a residue after decanting of nearly 3 cc. of particles ranging from 0.2 mm. to 7 mm. in diameter. The organic portion of the residue contained, in order of abundance, Foraminifera, Radiolaria, siliceous sponge spicules, spicules of Alcyonaria, and decomposed worm tubes.

### THE FORAMINIFERA

After washing and sorting, about 350 identifiable specimens of Foraminifera were obtained. These were distributed among the following species in the numbers indicated:

<i>Thurammina protea</i> Earland.....	1
<i>Marsipella elongata</i> Norman.....	1
<i>Bathysiphon filiformis</i> M. Sars.....	2
<i>Saccorhiza ramosa</i> (H. B. Brady).....	3
<i>Saccorhiza</i> sp.....	1
<i>Ammodiscus incertus</i> (D'Orbigny).....	5
<i>Tolypammina vagans</i> (H. B. Brady).....	2
<i>Miliammina arenacea</i> (Chapman).....	41
<i>Reophax scorpiurus</i> Montfort.....	23
<i>Reophax dentaliniformis</i> H. B. Brady.....	2
<i>Reophax spiculifera</i> H. B. Brady.....	5
<i>Reophax nodulosa</i> H. B. Brady.....	4
<i>Reophax distans</i> H. B. Brady.....	17
<i>Trochammina rotaliformis</i> Wright.....	40
<i>Trochammina globulosa</i> Cushman.....	3
<i>Trochammina nitida</i> H. B. Brady.....	4

<sup>1</sup>Vassar College, Poughkeepsie, New York.

<i>Trochammina turbinata</i> (H. B. Brady).....	2
<i>Trochammina nana</i> (H. B. Brady).....	22
<i>Trochammina rossensis</i> , n. sp.....	13
<i>Ammoglobigerina globigeriniformis</i> (Parker and Jones).....	13
<i>Haplophragmoides glomeratus</i> (H. B. Brady).....	9
<i>Haplophragmoides trullissatus</i> (H. B. Brady).....	9
<i>Haplophragmoides canariensis</i> (D'Orbigny).....	49
<i>Haplophragmoides umbilicatus</i> Pearcey.....	1
<i>Haplophragmoides subglobosus</i> (G. O. Sars).....	1
<i>Cyclammina gouldi</i> , n. sp.....	19
<i>Verneuilina bradyi</i> Cushman.....	5
<i>Gaudryina</i> sp.....	1
<i>Textularia tenuissima</i> Earland.....	11
<i>Textularia nilens</i> Earland.....	6
<i>Nonion umbilicatus</i> (Montagu).....	3
<i>Nonion pompilioides</i> (Fichtel and Moll).....	2
<i>Nonion depressulus</i> (Walker and Jacob).....	3
<i>Cibicides</i> cf. <i>refulgens</i> Montfort.....	3
<i>Globigerina pachyderma</i> (Ehrenberg).....	6
<i>Cassidulina subglobosa</i> H. B. Brady.....	7

Although Foraminifera with secreted calcareous tests comprise one-sixth of the species, they make up only 7.2 per cent of the individuals present. This condition is markedly different from that found by the 'Terra Nova' expedition<sup>1</sup> on the western side of the Ross Sea, where 60 per cent of the species collected were calcareous.

A survey of the data available seems to indicate a hitherto unrecognized system in the distribution of antarctic Foraminifera. Within sixty miles of the coasts of Antarctica and the larger sub-antarctic islands the calcareous species, despite the coldness of the water, are the predominant element in the fauna. This condition prevails to depths of 2000 feet, beyond which point we have little evidence at the present time. Farther offshore, in similar depths, the agglutinated species become the more abundant forms. The change in relative abundance results partly from an actual increase in the agglutinated forms, but chiefly from the almost complete elimination of the Lagenidae and Rotaliidae at the greater distances.

Nearly half of the specimens of calcareous species found at the Bay of Whales were distorted or otherwise atypical. *Cibicides* cf. *refulgens* Montfort, for example, develops in the later chambers an imperforate, porcellaneous wall with a chitinous lining. If the younger specimens were not more typical these differences would be sufficient to remove the Bay of Whales forms not only from the genus but even the family in which they are normally placed.

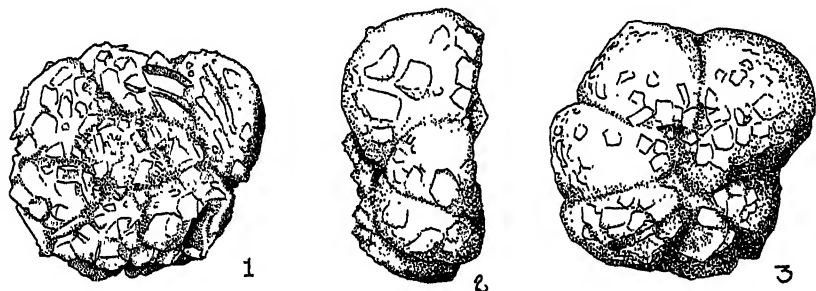
<sup>1</sup>1922, British Antarctic ('Terra Nova') Exped., Zool., VI, No. 2.

## DESCRIPTIONS OF NEW SPECIES

*Trochammina rossensis*, new species

Figures 1 to 3

TYPE DESCRIPTION.—Test turbinate, rotaloid, two coils visible on the flat dorsal side, only the last whorl showing on the deep ventral side; periphery slightly lobulate in lateral view; chambers appressed on the dorsal surface, less so ventrally, six in the last whorl; sutures slightly depressed, obscure dorsally; wall of unassorted sand grains, usually coarser on the dorsal than on the ventral side; cementing material clay with chitinous or ferruginous bonding; surface rough, especially on the dorsal side; aperture usually obscure, a narrow slit at the base of the last septum, extending from the umbilicus one-half the distance to the periphery; color white or yellow-brown. Diameter of holotype, 0.75 mm.



Figs. 1-3. *Trochammina rossensis*, new species, holotype,  $\times 50$ .

1. Dorsal view. 2. Peripheral view. 3. Ventral view.

TYPE.—The holotype is deposited in The American Museum of Natural History (Cat. No. A. M. N. H. 655). The three specimens under Cat. No. A. M. N. H. 656, are paratypes.

TYPE LOCALITY.—Bay of Whales, Ross Sea, depth 1680 feet.

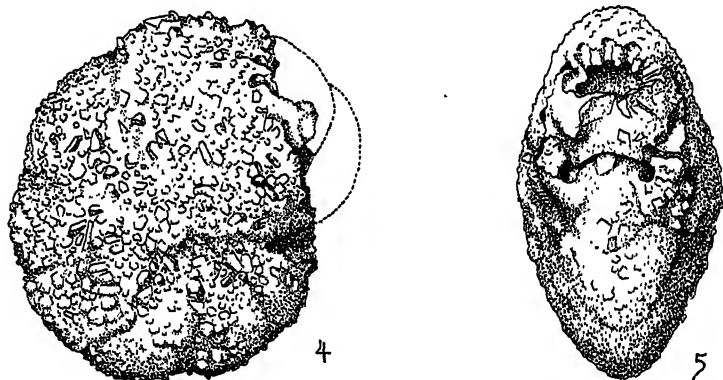
The flat dorsal and markedly convex ventral surfaces of this species will distinguish it from others of the genus which have a similar number of chambers in the last whorl.

*Cyclammina gouldi*, new species

Figures 4 and 5

TYPE DESCRIPTION.—Test nautiloid, biconvex in adults, somewhat umbilicate in young; edge narrowly rounded in adults, blunt in young specimens; periphery nearly smooth in lateral view; chambers appressed, nine in the last whorl, the latest ones showing a tendency for the coil to become evolute; sutures obscure, flush with the surface; wall of fine sand, poorly agglutinated with a ferruginous or chitinous cement; surface moderately smooth but not polished; aperture a curved slit at the base of the last septum, supplemented in adult chambers by other round apertures,

chiefly on the peripheral margin but also on the septal face and the equitant portions of the chamber wall; interior of adult chambers almost free of labyrinthic deposits; equitant portions of each chamber nearly separated internally from the rest of the chamber, communicating with it through constricted round orifices; color yellow or gray. Diameter of holotype, 1 mm.



Figs. 4, 5. *Cyclammina gouldi*, new species, holotype,  $\times 50$ .

4. Lateral view with outlines of broken terminal chambers restored. 5. Apertural view, showing orifices leading to the equitant parts of the last chamber, and broken peripheral apertures of the penultimate chamber.

TYPE.—The holotype and paratypes are deposited in The American Museum of Natural History under Cat. Nos. A. M. N. H. 657 and A. M. N. H. 658, respectively.

TYPE LOCALITY.—Bay of Whales, Ross Sea, depth 1680 feet.

The small number of chambers will serve to separate this species from other Cyclamminae with the exception of *C. bradyi* Cushman, which has a simple aperture and is smoothly finished.

The cementing material weakens on being dried, and the test will disintegrate in a few days if replaced in water. It crumbles in twenty seconds on being immersed in dilute hydrochloric acid, but without evolution of any gas.

THE SOLITARY BEES OF BARRO COLORADO ISLAND, CANAL  
ZONE

BY HERBERT F. SCHWARZ

This account of the bees of Barro Colorado Island is based primarily on specimens collected by members of the American Museum on successive visits to the island. Cognizance has also been taken of previously published records of the apifauna of Barro Colorado and of the records in the card catalogue of The Institute for Research in Tropical America. In several instances allusion has been made also to specimens collected in other parts of the Canal Zone or Panama by members of the American Museum, members of other institutions, or independent collectors.

In view of the persistence with which collections have been made on the island the number of known solitary bees, as distinguished from social or colonial bees, is small. The relatively restricted representation of these bees is perhaps explainable in part by the nature of the island. Bees, with certain exceptions, are more partial to the open country than they are to woodland, and except for a few small, widely separated clearings, aggregating only a few acres, Barro Colorado is a continuous stretch of tropical forest. As Dr. Frank M. Chapman has well said, "it is forested from end to end and bottom to top." Another factor that has limited collecting is the relative paucity of plants on the forest floor that bees might visit, most of the bloom being on the inaccessible forest roof. Finally, collections have been made only at certain times of the year, and doubtless the life cycle of some of the solitary bees of the island is so adjusted that they make their appearance in the adult form over only a limited period. A bee that emerges solely during July would not be seen by a collector visiting the island in November or December. Almost certainly there must be many more solitary bees than are here recorded. Nevertheless the list may not be unwelcome, at least as a nucleus.

In a subsequent paper consideration will be given to the social bees (Meliponidae) that have been collected on Barro Colorado Island. Of these, for reasons suggested in that paper, the representation is relatively much more complete.

In the bibliographies that precede each of the species considered, the references have been confined to the original description, to occa-

sional cases of synonymy, and to previous reports of the presence of the insect in question either in Panama or in the Canal Zone.

Unless stated to the contrary, all of the specimens here reported upon were collected on Barro Colorado Island.

### ***Colletes spiloptera* Cockerell**

*Colletes spiloptera* COCKERELL, 1917, Entomological News, p. 363.

*Colletes (Ptilopoda) maculipennis* FRIESE, 1921, Stettiner Entomologische Zeitung, LXXXII, p. 83.

Four males collected by C. H. Curran on Dec. 22, 1928, Dec. 23, 1928, Dec. 28, 1928, Jan. 3, 1929; three females, of which one was collected by C. H. Curran on Jan. 28, 1929 and two were collected by F. E. Lutz on March 5, 1933, on the clearing about the Laboratory.

Both Cockerell's *spiloptera* (described from Porto Bello, Panama) and Friese's *maculipennis* (described from San José, Costa Rica) were based on the male. It seems that *maculipennis* is probably a synonym of *spiloptera*. The female of *spiloptera* hitherto undescribed, has much the same general appearance as the male, but differs structurally in its shorter malar space (rather less than one-third as long as wide contrasted with one-half as long as wide in the male) and by its shorter antennae, which when extended backward are approximately level with the base of the tegulae, whereas those of the male reach the base of the scutellum. Joint 3 of the antennae of the female is approximately as long as joints 4 and 5 combined. In both sexes the four basal joints are black and the subsequent joints black above; in the female, however, joints 5-12 are ferruginous below, in the male joints 12 and 13 are wholly black. The female, like the male, has long fringes on the under side of the femora. The punctation of the abdominal tergites, particularly tergites 1 and 2, is much less heavy in the female than in the male.

In all of these respects the differences between the two sexes of *spiloptera* parallel those of the closely related *punctipennis*, of which there is a small series before me from Chichen Itza, Yucatan, donated by E. Thompson. The maculations on the wings of the specimens of *spiloptera* from Barro Colorado are rather stronger than those of *punctipennis* from Yucatan.

### ***Ptiloglossa fulvo-pilosa* (Cameron)**

*Megacilissa fulvo-pilosa* CAMERON, 1903, Trans. Amer. Ent. Soc., XXIX, pp. 237-238 (Panama, on Pacific side).

One male, Jan. 7, 1929, collected by C. H. Curran.

The specimen corresponds structurally and in most of its more super-

ficial characters with the description of Cameron but differs in one or two details. The lower inner orbits are black, not yellow, although the black chitin is almost concealed by exceedingly dense, fulvous pile. It is possible that the concealing character of this fulvous pile led Cameron to believe the area yellow. The center of the mesonotum of the present specimen is densely covered with hair like the rest of the mesonotum, and it seems possible that the bare, shiny area on the mesonotum referred to in Cameron's description may have been due to wear or injury. Such a differentiated median area is at variance with the condition in perfect specimens of *Philoglossa* and the closely related *Caupolicana* that I have examined, although in damaged specimens this area frequently shows a more or less denuded condition.

***Augochlora seminigra* Cockerell**

*Augochlora seminigra* COCKERELL, 1897, Trans. Amer. Ent. Soc., XXIV, pp. 144-145.

One female, Dec. 26, 1928, collected by C. H. Curran, and one female, March 22, 1933, collected by H. F. Schwarz.

***Augochlora quiriguensis* Cockerell**

*Augochlora quiriguensis* COCKERELL, 1928, Psyche, XXXV, p. 181 (Barro Colorado Island).

The specimen recorded by Cockerell from Barro Colorado had "the mesothorax black with green margins, to this extent agreeing with the variety *sidaefoliae* Cockerell. It is intermediate between the typical form and the variety."

***Augochlora fulgidana isthmii*, new subspecies**

FEMALE.—Agrees with typical *fulgidana* (originally described by Friese, 1921, as *fulgida*) both in sculpturing and coloration, except that the head, like the mesonotum, is for the most part copper-red (green in typical *fulgidana*), while tergites 1-4 are black, with slight greenish reflections at their sides, and tergites 3-4 likewise reflect green just in front of their broad, smooth, hairless and fringeless, black apical rims (in typical *fulgidana* tergites 1-4 are copper-red except for the black apical rims).

One female, Dec. 1, 1930, collected by H. F. Schwarz. Type in American Museum.

The specimen on which this description is based has been compared with a specimen from San José, Costa Rica, which bears Friese's type label.

The unusual coloration of this subspecies is suggestive of the *Augochlora* from Ecuador that Friese (1925, Stett. Ent. Zeit., LXXXVI, Heft 2, p. 6) described as *cupraria*, but *isthmii* does not accord fully,



either in its sculpturing or in the color of its hairs, with Friese's description of *cupraria*. Moreover, in the same paper in which *cupraria* is described, Friese draws comparison between what he describes as *atropilosa* and his *fulgidana*. It seems likely, therefore, that had his *cupraria* been as closely related to his *fulgidana* as *isthmii* is to *fulgidana*, he would not have neglected in describing *cupraria* to allude likewise to *fulgidana*.

The outer calcarium on the third tibiae of *cupraria* is described by Friese as bent at the tip. In *fulgidana* and its subspecies *isthmii* this calcarium is likewise sharply bent at its apex and ultra microscopically ciliate. The clypeus is rather produced and depressed just before the broadly rounded apical edge.

The abdomen of this subspecies seems to be rather like that of Cockerell's *bodkini*.

#### **Augochlora (Oxystoglossa) thalia Smith**

*Augochlora thalia* SMITH, 1879, 'Descriptions of new species of Hymenoptera in British Museum,' p. 46.

One female collected, March 4, 1933, by H. F. Schwarz.

I have not seen Smith's type of *thalia* from Brazil, but the description applies well to the present insect. The specimen also approximates in many respects *Augochlora azteca* Cockerell, of which the American Museum has a series from Brownsville, Texas. The present insect and *thalia*, like Cockerell's *cordiaefloris*, have all of the tibiae and tarsi ferruginous, whereas in *azteca*, as a rule, it is only the front tibiae (and not the middle and hind tibiae as well) that are red.

#### **Augochlora (Paraugochloropsis) auriventris Friese**

*Augochlora auriventris* FRIESE, 1921, Stett. Ent. Zeit., LXXXII, p. 87.

One female, Nov. 13, 1923 (F. E. Lutz); one male, Dec. 23, 1928, two females, Jan. 8, 1929 and Feb. 18, 1929, collected by C. H. Curran; one female, Dec. 1, 1930, collected by H. F. Schwarz.

A female was collected also by F. E. Lutz on the Chiva Chiva Trail, Nov. 18, 1923.

#### **Augochlora (Paraugochloropsis) vesta barro-coloradensis, new variety**

FEMALE.—Differs from the typical form, which has the "head and thorax golden green," and from the variety *terpsichore*, which has the head and thorax blue-green, in having the front, vertex, and mesonotum of a green strongly tinged with copper.

Abdominal tergites 2-4 are a coppery red, as described for the typical form, but the two apical segments are black with black hairs in contrast to the fulvous hairs over

tergites 1-4; tergites 1-2 have fulvous fringes along their apex, as indicated for *terpsichore*. The legs are dark, with greenish reflections. The hair on the coxae, trochanters, and femora is pale. On the outer side of the tibiae and tarsi dark hairs predominate. The hairs on the under side of the middle and hind basitarsi incline to golden. Length,  $7\frac{1}{2}$  mm.; length of fore wing, including tegula,  $6\frac{1}{2}$  mm.

One female, Jan. 10, 1929, collected by C. H. Curran. Type in American Museum.

The specimen on which the above description is based contrasts with those from other regions in the Canal Zone, which presumably are either typical *vesta* or the variety *terpsichore*. The head and thorax of these specimens appear to be pure green but in certain lights have bluish reflections. The tergites of some of them are brassy green, tinged with coppery red after the manner of some of Cockerell's specimens of *cupreola*, whereas others have the tergites entirely coppery red except for the two black apical tergites. The localities in the Canal Zone represented by these specimens are:

Balboa, June 19, 1914, Aug. 21, 1914, Oct. 4, 1914, Oct. 21, 1914, Nov. 15, 1914 (T. Hallinan), Nov. 7, 1923 (F. E. Lutz); Empire, Jan. 6, 1914 (T. Hallinan); Las Cruces Trail, near Corozal, Sept. 19, 1915 (T. Hallinan); Corozal, Jan. 3, 1929 (C. H. Curran) and Nov. 17, 1930 (H. F. Schwarz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz).

#### ***Augochlora* (*Odontochlora*) *mülleri* Cockerell**

*Augochlora mülleri* COCKERELL, 1900, Proc. Acad. Nat. Sci. Philadelphia, LII, pp. 361, 367.

One female, Nov. 13, 1923 (F. E. Lutz); two females, Dec. 1, 1930 (H. F. Schwarz); and four females, March 4-6, 1933 (H. F. Schwarz).

Females were collected also on Chiva Chiva Trail, Nov. 24, 1930 (H. F. Schwarz) and at Pacora, March 9, 1933 (H. F. Schwarz).

#### ***Augochlora* (*Odontochlora*) *smaragdina* Friese**

*Augochlora smaragdina* FRIESE, 1916, Stett. Ent. Zeit., LXXVII, p. 312.

One female, March 22, 1933, collected by H. F. Schwarz.

Females were taken also at Balboa, Aug. 20-21, 1914 (T. Hallinan), and on the Culebra-Arrijan Trail, Jan. 1, 1915 (T. Hallinan).

This species was described by Friese from San José, Costa Rica. There are in the American Museum collection two females from San Mateo, Costa Rica, dated July 7, 1920 and May, 1921, respectively, which Friese had identified as *smaragdina* and to which he has attached type labels. These specimens, which have the rank of metatypes, agree

with the specimens here designated *smaragdina* but depart from the description of *smaragdina* in one or two details. The principal point of departure is that both the San Mateo specimens and the Canal Zone specimens have very narrow black apices to the abdominal tergites, whereas, according to Friese, *smaragdina* differs from *graminea* partly because of the absence of such black rims in *smaragdina*. I am assuming that the San Mateo specimens, notwithstanding this seeming discrepancy, are sufficiently close to the holotype to be considered true *smaragdina*. If so, it should be noted that *smaragdina*, like *milleri*, belongs to that division (*Odontochlora*) of *Augochlora* that has a spine at the base of the under side of the abdomen, and that the tuft of brown hairs which, according to Friese, occurs on the sides of tergite 6 is even more conspicuously developed on the sides of tergite 5.

***Augochlora (Odontochlora) nigrocyanea* Cockerell**

*Augochlora nigrocyanea* COCKERELL, 1897, Trans. Amer. Ent. Soc., XXIV, p. 144.

*Augochlora nigrocyanea* COCKERELL, 1928, Psyche, XXXV, p. 181 (Ancon).

One female was collected by F. E. Lutz on Nov. 13, 1923.

Females have been collected also in other localities of the Canal Zone as follows: Balboa, Nov. 11, 1914 (T. Hallinan), and Nov. 7, 1923, at a yellow "morning glory" (F. E. Lutz); Chiva Chiva Trail, March 11, 1933 (H. F. Schwarz). Males were collected at Balboa by T. Hallinan on Oct. 15, 1914 and on Aug. 20, 1915.

There is great variability in the development of the spine at the base of the venter. In some specimens (including the one from Barro Colorado) it may even be lacking. As this spine is a subgeneric character in *Odontochlora*, one would be tempted to consider the insects lacking this character as distinct if they were not connected by intergrades with the heavily spined specimens.

***Megalopta fornix panamensis* Cockerell**

*Megalopta fornix* var. *panamensis* COCKERELL, 1919, Proc. U. S. Nat. Mus., LV, p. 207 (Trinidad Rio, Panama; Boquete, Chiriqui, Panama; and Paraiso, Canal Zone).

*Megalopta fornix* var. *panamensis* FRIESE, 1926, Stett. Ent. Zeit., LXXXVII, pp. 133-134 (repeats description and locality records of Cockerell, 1919).

*Megalopta fornix panamensis* COCKERELL, 1928, Psyche, XXXV, p. 181 (Barro Colorado Island).

*Megalopta fornix panamensis* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' p. 185 (Barro Colorado Island).

Two females, Nov. 22-23, 1930, collected by H. F. Schwarz; two females, Nov. 27, 1930, collected by E. I. Huntington; eleven females,

Feb. 26 to March 21, 1933, and one male, March 18, 1933, collected by F. E. Lutz.

All of these specimens were taken at light either at the Laboratory or at the house of Dr. F. E. Chapman on the laboratory clearing of Barro Colorado Island. The specimen reported in Mr. Rau's book was "found in the laboratory at six A.M. on September 22."

Considerable variability occurs among the individuals of this relatively large series. Vachal (1904, Misc. Ent., pp. 113-114) in his key to what he classifies as "*Halicti megalopti*" gives as one of the characters of his *fornix* a six-spined condition of the calcaria. Cockerell (1919, Proc. U. S. Nat. Mus., LV, p. 207) does not mention the number of spines on the calcaria of his *fornix panamensis*. An examination of the series before me indicates that the number of spines varies from 4 to 7, with 5 spines the more usual condition. There are even several cases of asymmetry, 4 spines occurring on the posterior calcarium of one of the hind legs and 5 spines on the posterior calcarium of the opposite hind leg, or 5 spines on the posterior calcarium of one of the hind legs and 6 spines on the posterior calcarium of the other.<sup>1</sup>

In some of the specimens there is an angulation on the under side of the cheeks that suggests the feeble beginnings of the strongly developed tubercle or stout obtuse spine characteristic of what has here been identified as *Megalopta genalis*. The sculpturing of *M. fornix panamensis* is very similar to that of the specimen identified as *genalis*, even to the inclusion of the characteristic basal area of the median segment. Although Meade-Waldo states in the case of his *genalis* that "joint 3 of antennae is hardly longer than joint 4," the specimen of what I believe to be *genalis* does not differ greatly in the proportions of its antennal segments from *fornix panamensis*. Looked at from the side where joint 3 is shortest, the difference in length between joints 3 and 4 is not great, but looked at from the side where joint 3 is longest, the relative length as between joints 3 and 4 distinctly favors joint 3.

The size of the females of *fornix panamensis* in the series before me varies from 10½ to 13 mm. as against 10½ to 12 mm. in the case of the two females on which Cockerell's description was based. Even the individuals of maximum size in the present series fall far short of the 17 mm. indicated by Vachal for typical *fornix*.

<sup>1</sup>Comparable variability is found in the genus *Augochlora*. Schrottky (1909, Deutsch. Ent. Zeit. p. 481) restricted Cockerell's *Augochloropsis* to *Augochlora*-like bees that have only three spines on the hind calcarium of the third tibiae, established the subgenus *Trachlora* somewhat diffidently for those *Augochlora* that have four spines on this calcarium, and, because of the frequent variability in the number of the spines in excess of four, lumped all *Augochlora* having from 5 to 7 spines in the subgenus *Paraugochloropsis*. Other writers, too (for instance Cockerell, 1906, in Canadian Entomologist, XXXVIII, p. 162) refer to asymmetry in the number of the spines in *Augochlora*.

Several of the females were bearing pollen. The pollen grains, although all of pale hue, were of at least four different types, indicating that these bees do not favor a single flower. The pollen grains on one of the bees were globular and semitransparent; on a second bee globular and semitransparent but of much smaller diameter; on a third bee transparent, oval in outline, flattened, with microscopic sculpturing; on a fourth powder-like and dull white.

***Megalopta genalis* Meade-Waldo**

*Megalopta genalis* MEADE-WALDO, 1916, *Annals and Mag. Nat. Hist.*, (8) XVII, pp. 452, 453-454 (Bugaba, Panama).

One female, collected by F. E. Lutz, March 23, 1933, at light, near the Laboratory.

The specimen agrees with the description of Meade-Waldo except in the following details. Meade-Waldo states that the number of spines on the posterior calcarium of the third pair of legs is 4, whereas the present specimen has 6 spines on this calcarium—approximating the condition in Friese's *armata* from Ecuador, which in other respects also seems very similar. The fact that *fornix panamensis* varies greatly in the number of spines on the calcaria leads me to think that a similar range of variability may occur in *genalis*.

The second point of difference is in the relative length of the hind tibiae and hind basitarsi, which, according to Meade-Waldo's description, are of equal length. In the specimen from Barro Colorado the hind tibiae are distinctly longer than the hind basitarsi, agreeing in this respect with all the species of *Megalopa* that I have had a chance to examine. It seemed barely possible that an error had crept into Meade-Waldo's description respecting the relative length of the hind tibiae and hind basitarsi and I accordingly requested Mr. Robert B. Benson, of the British Museum, to examine the type of *genalis* with reference to the proportions of these joints and other details. Mr. Benson has kindly written me as follows:

In reply to your letter of the 2nd June, I have examined Meade-Waldo's type of *Megalopta genalis*. The comb on the calcaria of the hind tibia appears to me to have five spines on the left leg and six on the right leg, that is including the apical spine. The posterior tibia is certainly longer than the metatarsus (2.9 mm. and 2.2 mm.). There are several specimens of this species that have been added to the collection later from Colombia, Gorgona Island, 1 ♀ July 1924, 1 ♀ October 1924, Miss L. F. Cheesman; 1 ♀ July 1924, 2 ♀ October 1924, Miss C. Longfield.

Thus, differences that existed between Meade-Waldo's description and the Barro Colorado specimen have been reconciled through an examination of Meade-Waldo's type.

**Xylocopa fimbriata** Fabricius

*Xylocopa fimbriata* FABRICIUS, 1804, 'Syst. Piez.,' p. 340.

*Xylocopa fimbriata* CHERSMAN, 1929, Trans. Entom. Soc. London, LXXVII, p. 144 (Taboga Is.).

*Xylocopa fimbriata* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' p. 185 (Barro Colorado Island).

Rau enumerates this bee in his account of the bees and wasps of Barro Colorado.

In the American Museum collections there are females of this species from Ancon, Nov. 21, 1923, and Taboga Island, Nov. 23, 1923, collected by F. E. Lutz.

**Xylocopa splendidula** Lepeletier

*Xylocopa splendidula* LEPELETIER, 1841, 'Histoire Nat. des Insectes, Hyménoptères,' II, p. 190.

*Xylocopa splendidula* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' p. 185 (Barro Colorado Island).

This species was collected by Rau in September.

**Ceratina laticeps** Friese

*Ceratina laticeps* FRIESE, 1921, Stett. Ent. Zeit., LXXXII, p. 88.

One female, March 6, 1933, collected by H. F. Schwarz.

This insect accords with one of Friese's type specimens of *laticeps* from San José, Costa Rica.

**Ceratina sublaticeps**, new species

FEMALE.—Identical with *laticeps* Friese except that the two enormous teeth on the under side of the head, characteristic of *laticeps*, are reduced to spines of moderate size that are not hollowed out or shovel-like anteriorly and are mostly rust-red instead of black. The large tubercles on the apical edge of the labrum, a conspicuous character in *laticeps*, are in *sublaticeps* much reduced and scarcely to be differentiated from the horseshoe-shaped rim of which they form a part. A rust-red linear maculation, absent in *laticeps*, traverses the lower part of the clypeus transversely, interrupted at the middle by the large, pale yellow maculation.

One female, Jan. 10, 1929, collected by C. H. Curran. Type in American Museum.

Further collecting may establish whether *laticeps* and *sublaticeps* are merely extremes connected by intermediates. Yet it is perhaps significant that Friese, who in 1920 obtained large numbers of *laticeps* from San José, Costa Rica, in his description based on these specimens, does not indicate variability within *laticeps*.

Friese's *crassiceps* seems to be a fairly close relative of *laticeps* and *sublaticeps*.

***Ceratina mexicana zeteki*, new subspecies**

FEMALE.—Differs from *mexicana* in having only a relatively small oval spot on the clypeus where typical *mexicana* has a median maculation that extends from apex nearly to base, this median maculation in the case of typical *mexicana* being flanked by two semidetached smaller spots. The subspecies *zeteki*, like typical *mexicana*, is for the most part "black slightly tinged with bronze," but its genae, unlike those of typical *mexicana*, reflect a strong metallic green. The posterior part of the scutellum, the postscutellum, and the basal part of the metathorax of *zeteki* also reflect green, especially when viewed from behind. On the sides of the face of *zeteki* there is a roseate to copper-green reflection and the unmaculated parts of the clypeus reflect purple. There is a rust-colored spot at the apex of the scape. The tergites are almost wholly blackish, the apical ones with a subdued, very dull green reflection, not "golden at the tip" as in typical *mexicana*.

One female, Dec. 30, 1928, collected by C. H. Curran and named in honor of Mr. James Zetek, whose zealous and untiring efforts on behalf of Barro Colorado Island have earned the gratitude of every visitor to its shores.

*Ceratina azteca* Cresson is a close relative of *mexicana* and its subspecies *zeteki*. However, *azteca* lacks the maculations on the apex of the front femora and the base of the front tibiae that characterize *mexicana* and *zeteki* and it is somewhat more strongly (though still very finely) punctured on tergite 1. In *zeteki* this tergite is polished and in *mexicana* virtually so, the traces of punctuation being exceedingly faint. *Ceratina azteca* has a greater prevalence of blue-green than has *zeteki*. These comparisons are based on an examination of the types of *mexicana* and *azteca* in connection with the present subspecies.

***Ceratina laeta* Spinola**

*Ceratina laeta* SPINOLA, 1841, Ann. Soc. Ent. France, X, p. 138.

*Ceratina laeta* SMITH, 1861, Trans. Ent. Soc. London (3) I, p. 40 (Panama).

Two females were collected, Dec. 23, 1928, by C. H. Curran and one female was collected, Dec. 3, 1930, by H. F. Schwarz at the Rear Light House on Barro Colorado.

Females were collected by T. Hallinan from other localities in the Canal Zone as follows: Empire, Aug. 30, 1914; Culebra-Arrijan Trail, Dec. 20, 1914; Culebra, Dec. 21, 1914; Ancon, Jan. 28, 1916 and Feb. 3, 1916.

In addition a male was taken at Las Sabanas, near Panama City, Nov. 17, 1923, by F. E. Lutz. This male accords with Friese's description of that sex (1916, Stett. Ent. Zeit., LXXVII, p. 322). *Ceratina viridula* Smith, which Cockerell (1928, Psyche, XXXV, p. 176) has

reported from Taboga Island, seems to be very closely related to *Spinola's laeta*, but Smith's description of the male of *viridula* makes reference neither to a maculation at the base of the mandibles nor to another, though smaller maculation, at the inferior extremity of the sides of the face—both of these maculations being present in the *laeta* male as interpreted by Friese. The male from Las Sabanas has two widely separated, acute black spines at the middle of the apex of the penultimate sternite, not mentioned in Friese's description.

The male of *cobaltina*, as Cresson indicates, has "the apical segment obtusely bidentate at tip"; in the male of *laeta* as conceived by Friese and in the male of *viridula* this segment is entire. I have examined the type of *cobaltina* and find that the basal area of tergites 2-3 of *cobaltina* (that area that Cresson speaks of as having "a golden reflection in certain lights" but that under other light conditions is rather dark-colored) has longitudinal plicae of irregular length in contrast to the condition in *laeta*, which has these basal areas mostly smooth with a few punctures but no plicae.

#### *Centris lanipes* Fabricius

*Apis lanipes* FABRICIUS, 1775, 'Syst. Ent.,' p. 386.

*Centris lanipes* FABRICIUS, 1804, 'Syst. Piez.,' p. 260.

One female, March 5, 1933, collected by F. E. Lutz.

Two females were collected also at Pacora, Panama, on March 19, 1933, by H. F. Schwarz.

It is difficult to decide from the brief description given by Fabricius whether his *lanipes* is indeed the insect that Friese interprets it to be. Smith's *tarsata*, which Friese (1900, Annalen k. k. naturhist. Hof-museums, XV, p. 313) regarded merely as a variety of *lanipes*, was reported from Barro Colorado by Cockerell.

#### *Centris labrosa* Friese

*Centris labrosa* FRIESE, 1899, Termész. Füzetek, XXIII, p. 44.

One female, collected Nov. 15, 1930, by E. I. Huntington.

This specimen is only 11½ mm. long and might seem, therefore, to be assignable to the variety *simplex* rather than to true *labrosa*, which is described as being 14-16 mm. in length. However, the hairs of the mesonotum and of the scutellum are dark-tipped as in the typical variety, and the specimen has accordingly been placed with true *labrosa*.

Females were collected also at Corozal, Jan. 16, 1929, and Jan. 21, 1929, by C. H. Curran.



**Centris labrosa variety simplex Friese**

*Centris labrosa* var. *simplex* FRIESE, 1899, Termész. Füzetek, XXIII, p. 44.

One female, collected Nov. 29, 1930, by H. F. Schwarz.

Just as the specimens from the Canal Zone of true *labrosa* are smaller than specimens from other regions, so the Barro Colorado example of the var. *simplex* falls below the specifications of size given for that variety by Friese. Indeed in stature it is rather like *lanipes*, being only 10 mm. in length instead of 12–13 mm. as noted in Friese's description. Its thoracic hairs correspond in coloration with those of the variety *simplex*.

Specimens of *simplex* from other localities in the Canal Zone are more nearly of orthodox size. These localities include Balboa, June 28–29, 1914 (T. Hallinan), and Empire, Aug. 30, 1914 (T. Hallinan).

**Centris proxima Friese**

*Centris (Rhodocentris) proxima* FRIESE, 1900, Annalen des k. k. naturhist. Hof-museums, XV, pp. 243, 307.

*Centris proxima* COCKERELL, 1919, Proc. U. S. Nat. Mus., LV, p. 190 (Alhajuela,

Four males, Feb. 27, 1933 (F. E. Lutz), one female, March 6, 1933 (H. F. Schwarz), and one female, March 7, 1933 (F. E. Lutz).

Regarding the four males collected on Feb. 27, Dr. Lutz has the following field note:

"A *Centris* was buzzing about the end of a folded banana leaf. In sweeping the net to catch it (about 4:30 P.M.) I hit the leaf and was surprised to find that I had caught four or five. Apparently they had gone in there to sleep."

The males are even smaller than those reported by Crawford (1906), being about 13 mm. in length; the female is between 16 and 17 mm.

**Centris inermis gualanensis Cockerell**

*Centris inermis gualanensis* COCKERELL, 1912, Annals and Mag. Nat. Hist., (8) IX, p. 568.

One female, March 7, 1933, collected by F. E. Lutz.

The specimen is slightly smaller than the specimens on which Cockerell's description is based (about 15 mm. instead of about 17 or 18) and the labrum lacks a dark apical spot. However, the forelegs and middle legs are largely dark and in other respects, too, the specimen accords with Cockerell's description. Typical *inermis* has been reported by Cockerell from Red Tank in the Canal Zone (1928, Psyche, XXXV, p.

173), and a specimen assignable to the variety *gualanensis* was collected by T. Hallinan at Balboa on Nov. 6, 1916.

***Centris poecila* Lepeletier**

*Centris poecila* LÉPELETIER, 1841, 'Histoire Nat. des Insectes, Hyménoptères, II, pp. 154-155.

*Centris poecila* GRIRODO, 1893, Bull. della Soc. Ent. Italiana, XXV, pp. 267-268 (Chiriqui, Panama; description of the male).

*Centris poecila* COCKERELL, 1928, Psyche, XXXV, p. 173 (Red Tank, Canal Zone).

One female, March 15, 1933, collected by H. F. Schwarz.

This species has been collected also at the following localities in the Canal Zone: Balboa, April 21, 1914, June 12, 1914 (male), and June 12, 1915, by T. Hallinan; Farfan, May 8, 1915, by T. Hallinan.

***Centris tarsata* Smith**

*Centris tarsata* SMITH, 1874, Annals and Mag. Nat. Hist. (4) XIII, p. 371.

*Centris tarsata* COCKERELL, 1928, Psyche, XXXV, p. 173 (Barro Colorado Island).

A specimen, collected by N. Banks on July 23, 1924, is recorded in the catalogue of the Laboratory.

***Melitoma fulvifrons marginella* (Cresson)**

*Melissodes ? marginella* CRESSON, 1872, Trans. Amer. Ent. Soc., IV, p. 282.

One male, Dec. 23, 1928 (C. H. Curran).

***Tetrapedia calcarata* Cresson**

*Tetrapedia calcarata* CRESSON, 1878, Trans. Amer. Ent. Soc., VII, p. 136.

One female, Nov. 13, 1923 (F. E. Lutz) and one female, Dec. 12, 1928 (C. H. Curran).

In Cresson's description no mention is made of two rather faint, narrow, longitudinal stripes of dull yellow that are traceable on the mesonotum of the type and are present also in the Barro Colorado specimens and in specimens from Guatemala. In a series from Guatemala of the closely related *Tetrapedia abdominalis* Cresson these thoracic stripes are lacking. *Tetrapedia calcarata* also has the axillae maculated, whereas in *abdominalis* the axillae are black.

Other localities in the Canal Zone where this species has been collected are: Ancon, March 4, 1914 (T. Hallinan), and Culebra-Arrijan Trail, Nov. 29, 1914 (T. Hallinan).

***Tetrapedia lugubris* Cresson**

*Tetrapedia lugubris* CRESSON, 1878, Trans. Amer. Ent. Soc., VII, p. 135.

One male, Jan. 7, 1929, collected by C. H. Curran.

Cresson described the legs of *lugubris* as "simple," contrasting them with those of the male of *maura*, but as a matter of fact they are not wholly simple. An examination of Cresson's type shows that on the under side of the hind metatarsi, somewhat above the middle of the anterior edge, there is a rather strong tooth. The patch of white pubescence posteriorly on the apical tip of the hind tibiae is frequently absent, judging from a series before me from Guatemala, and the pale spots on the extreme sides of the fourth and fifth tergites of the abdomen are also, it seems, possibly the exception rather than the rule. These abdominal markings as well as the white hair patch on the apex of the hind tibiae are absent in the specimen of *lugubris* from Barro Colorado, which structurally is in agreement with Cresson's type.

I have checked with Cresson's type also a metatype of Friesse's *Tetrapedia dentiventris* from San José, Costa Rica. Friesse's insect agrees with Cresson's even to the inclusion of the white tibial hair patch and the abdominal markings. Friesse's insect, however, is of somewhat larger size.

***Osiris barro-coloradensis*, new species**

FEMALE.—For the most part impunctate and shiny. Honey-colored to ferruginous with black areas.

The head black except for the broadly truncated clypeus, protuberant supra-clypeal area, basal two-thirds of mandibles, labrum, scape in front, and flagellum more or less beneath—all of these areas being honey-colored. The outermost tooth of the mandible extending conspicuously beyond the succeeding tooth, which is dwarfed in comparison. The clypeus and supra-clypeal area shiny, with sparse, blotchy, rather large but shallow punctures. The front rather depressed, below the level of the clypeus the supra-clypeal area, and even the sides of the face, and clothed like the sides of the face fairly densely with scalelike, appressed ochraceous to olivaceous hairs. Rather similar appressed hairs clothe the cheeks. The hairs on the clypeus, labrum, and mandibles, though erect, are rather sparse, pale, and inconspicuous. A longitudinal carina extends from the middle ocellus to the summit of the supra-clypeal area. Segment 4 of the antennae longer than either segment 3 or segment 5. The eyes somewhat convergent below.

The upper third of the mesopleura, the mesonotum, the axillae (in part) black; the other parts of the thorax honey-colored. The pronotum emarginate above at the middle with the area to each side of the emargination rather swollen, even tuberculate in appearance. The mesonotum with three short, impressed lines on its anterior half. The mesopleura with a few, not readily traceable, large but shallow, blotchy punctures. The hair on the mesonotum scalelike, appressed and ochraceous (similar to that of the front); erect, honey-colored, but somewhat inconspicuous hairs on the pronotum,

tubercles, and mesopleura; longer, erect, and honey-colored but more conspicuous hairs on the scutellum and the sides of the propodeum, the middle of which is bare, polished and shiny.

The legs honey-colored to ferruginous except for the following parts: hind tibiae, which grade from honey color at the base to dark brown or black at the apex; the wholly black hind basitarsi, which are oval in shape, flat on their under side, distinctly convex to swollen on their outer side, and at their broadest distinctly broader than the corresponding tibiae. The calcaria are long, honey-colored and ultramicroscopically ciliate along their inner surface. The hair of the legs is concolorous with the areas covered, black on the black parts, honey-colored on the honey-colored areas. The tarsal claws are bulbous at the base and have a V-shaped cleft; the longer arm of each claw runs to an exceedingly fine, sharp point.

The wings hyaline with pale honey-colored venation and stigma. Eight hamuli on anterior margin of hind wing.

The abdomen rather more reddish than the pale honey-colored clypeus and scutellum, of somewhat uneven hue but not suffused with black. The tergites bare, shiny, and hairless. The last sternite much produced and narrow. The long, exposed, forward-directed sting nearly attaining the apex of tergite 2. The venter with a few ferruginous hairs.

Length about 7 mm., exclusive of the sting.

One female, collected on Barro Colorado, Feb. 27, 1933, by H. F. Schwarz.

Apparently closely related to *Osiris panamensis* Cockerell and *Osiris aculeatus* Friese. It differs from the descriptions of both in having the tibial spurs of the middle and hind legs honey-colored to ferruginous, not "dark" as indicated for *panamensis* nor "black" as indicated for the calcaria of the hind leg of *aculeatus*. There are no reddish marks above each eye as indicated for *panamensis*. The mesopleura are sharply divided into a black basal region and a red apical region, whereas *panamensis* is said to have "mesothorax black" and in the case of *aculeatus* only the mesonotum of the thorax is mentioned as being black. The basitarsi of the hind legs are black, swollen, and broader than their tibiae, not of like width as noted for *panamensis* and *aculeatus*. In size the present species aligns itself with *panamensis* rather than with the larger *aculeatus*, but the mandibles are black at the apex, not unicolorous as Friese interprets the mandibles of *panamensis* to be.

#### *Euglossa piliventris* Guérin

*Euglossa piliventris* GUÉRIN, 1845, 'Iconographie du Règne Animal,' III de Cuvier, p. 458.

One female, Dec. 24, 1928 (C. H. Curran) and one male, Feb. 28, 1933 (H. F. Schwarz).

The hind margins of the tergites of these specimens "when seen

from a direction opposite the light" are a rich purple, approaching the condition described by Cockerell in his variety *imperiulis*. However, specimens from other localities—Brazil, Bolivia, Costa Rica—also reflect purple when similarly viewed.

In the catalogue of the Laboratory on Barro Colorado Island are recorded one female, April 18, 1926, and two males, May 10, 1926, that were collected by C. T. Greene and identified by S. A. Rohwer.

***Euglossa piliventris* variety *imperialis* Cockerell**

*Euglossa (Glossura) piliventris imperialis* COCKERELL, 1922, Proc. of U. S. Nat. Mus., LX, Art. 18, p. 6 (Rio Trinidad, Panama).

*Euglossa piliventris imperialis* COCKERELL, 1928, Psyche, XXXV, p. 173 (Barro Colorado Island).

In addition to the record published by Cockerell in 1928 there is in the catalogue at the Laboratory on Barro Colorado record of a specimen collected July 13, 1924, by N. Banks, the determination having been made at the Museum of Comparative Zoölogy.

***Euglossa cordata* (Linnaeus)**

*Apis cordata* LINNAEUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 575.

*Euglossa cordata* SMITH, 1862, Trans. Ent. Soc. London, (3) I, p. 41 (Panama).

*Euglossa cordata* COCKERELL, 1922, Proc. U. S. Nat. Mus., LX, Art. 18, p. 7 (Ancon, Alhajuela, Paraiso, Taboga Island, Matico, Hernandez).

*Euglossa cordata* COCKERELL, 1928, Psyche, XXXV, p. 175 (Barro Colorado Island).

*Euglossa cordata* CHEESMAN, 1929, Trans. Entom. Soc. London, LXXVII, p. 145 (Taboga Island).

Two females collected, Dec. 24, 1928 (C. H. Curran) and March 2, 1933 (F. E. Iutz).

Females were collected also at Balboa, Jan. 23, 1914 (T. Hallinan); Farfan, June 20, 1915 (T. Hallinan); Culebra, Dec. 27, 1914 (T. Hallinan); Corozal, Jan. 21, 1929 (C. H. Curran). Males were collected at Balboa, July 17, 1914 (T. Hallinan); Patilla Point, Feb. 1, 1929 (C. H. Curran); Pacora, March 19, 1933 (H. F. Schwarz).

***Euglossa variabilis mixta* Friese**

*Euglossa variabilis mixta* FRIESE, 1899, Termész. Füzetek, XXII, p. 135 (Chiriqui, Panama).

*Euglossa variabilis mixta* COCKERELL, 1917, Canadian Entomologist, XLIX, p. 145 (Tabernilla, Cabima, and Las Cascadas, near the Canal, Panama).

*Euglossa variabilis mixta* COCKERELL, 1922, Proc. U. S. Nat. Mus., LX, Art. 18, p. 6 (Rio Trinidad, Panama).

In the catalogue at the Laboratory, Barro Colorado, there is record of two females collected by C. T. Greene, May 10-12, 1926, and identified by S. A. Rohwer.

***Euglossa cupreiventris* Cheesman**

?*Euglossa igniventris* FRIESE, 1925, Stett. Ent. Zeit., LXXXVI, Heft 2, pp. 29-30.

*Euglossa cupreiventris* CHEESMAN, 1929, Trans. Ent. Society London, LXXVII, p. 146 (Panama).

Two females, Feb. 26 and March 3, 1933 (F. E. Lutz). One of the specimens was collected "in the forest, near the 'Allee tree'."

This species seems to be very closely related to *Euglossa igniventris* from Costa Rica. Miss Cheesman's description of the punctation of the abdomen applies to the specimens before me rather more closely than does the description of Friese, who speaks of the abdominal punctation of his *igniventris* as "fast runzlig." But, while it is true that the apical part of tergite 1 and at least the greater part of tergite 2 is finely if densely punctured, the sides of these tergites and of the succeeding tergites are roughened, and it may be that Friese was concentrating on these lateral areas when drawing up his description. Miss Cheesman's detailed description of the thoracic punctation applies well to the present specimens.

Friese describes the coloration of his *igniventris* as blue-green (except for the reddish-golden abdomen). In the specimens before me the head, thorax, and legs are of a deeper green than the corresponding parts in Smith's *ignita* and reflect deep blue to purple in certain lights. The reverse side of the hind tibiae and hind femora is of a particularly deep purple hue (almost blackish in the case of the hind tibiae). The outer side of the hind tibiae, on the other hand, is a brassy green (more golden in most lights than the other parts and even with a trace of pink, as stated by Miss Cheesman, but in some lights there are bluish tints even over its shiny surface).

The scutellar cushion, as described for both *igniventris* and *cupreiventris*, is very minute, and a metallic red to copper-colored abdomen characterizes both of these species.

In addition to the specimens from Barro Colorado, there are in the American Museum two females of *cupreiventris* from Balboa, Canal Zone, Oct. 20, 1914, and June 27, 1915 (T. Hallinan), and one male, Nov. 5, 1914 (T. Hallinan).

In contrast to the female the male has its clypeus extensively purple and the inner orbits of the eye are bordered on their lower third by a

narrow cream-colored stripe; the stripe on the scape is more distinct than in the female. The scutellum, like that of the female, is level, not with a median longitudinal depression. In the specimen under consideration there is, curiously enough, a little tuft of erect hairs in the same position as the scutellar cushion of the female, but this unusual character may be peculiar to the individual. The four basal abdominal tergites of the male are colored like those of the female, but the three apical tergites are green.

***Euglossa cyanura* Cockerell**

*Euglossa cyanura* COCKERELL, 1917, Canadian Entomologist, XLIX, p. 146 (Porto Bello, Panama).

One female, Jan. 7, 1929, collected by C. H. Curran.

***Euglossa (Eulaema) dimidiata* (Fabricius)**

*Apis dimidiata* FABRICIUS, 1793, 'Ent. Syst. Emendata,' II, p. 316.

*Euglossa (Eulema) dimidiata* FRIESE, 1899, Termész Füzetek, XXII, pp. 130, 133, 164-165 (Panama).

*Euglossa dimidiata* SCHROTTKY, 1903, Revista do Museu Paulista, V (1902), pp. 535, 538, 598 (Chiriqui).

One female, Nov. 9-10, 1923 (F. E. Lutz), three females, Dec. 21, 1928 (C. H. Curran), one female, March 7, 1933 (F. E. Lutz), one male, Feb. 26, 1933 (E. I. Huntington).

In at least three of the females and in the male the hairs on the apical portion of tergite 4 incline to yellow rather than red, being only slightly warmer in tint than the yellow hairs on the apices of tergites 1-3. In this respect these specimens seem to approach Friese's variety *flavescens*, but tergites 1-3, unlike *flavescens*, are of normal width and tergites 5-6 (7) have the fox-red hairs of the typical subspecies, not the yellow hairs that distinguish *flavescens*.

In the card catalogue of the Laboratory at Barro Colorado Island there is record of two females of *dimidiata* collected May 10-12, 1926, by C. T. Greene and identified by S. A. Rohwer.

***Exaerete frontalis* (Guérin)**

*Euglossa frontalis* GUÉRIN, 1845, 'Iconographie du Règne Animal,' III de Cuvier, p. 458.

One female, March 23, 1933, collected by E. I. Huntington.

The specimen is somewhat smaller than that on which Guérin's description was based (23 mm. as against 28 mm.) and it is smaller, too, than a series of *frontalis* from Rio Caiary-Uaupes, State of Amazonas,

Brazil, Sept. 13, 1906 (H. Schmidt), in the American Museum collection. The specimen from Barro Colorado is slightly blue-green in contrast to the purer green of the Amazonas specimens, and in certain lights its reflections are purple. Nevertheless, structurally it alligns itself with *frontalis* and hence I have so designated it.

***Megachile candidella* Mitchell**

*Megachile candidella* MITCHELL, 1930, Trans. Amer. Ent. Soc., LVI, pp. 167, 206.

One female, Feb. 27, 1933, collected by H. F. Schwarz.

***Megachile mexicanum* Cresson**

*Megachile mexicanum* CRESSON, 1878, Trans. Amer. Ent. Soc., VII, pp. 127-128.

One female, Feb. 18, 1929 (C. H. Curran), and one male, March 3, 1933 (H. F. Schwarz).

The male is the only sex represented in the collection of Cresson's types at the Academy of Natural Sciences of Philadelphia. The male collected at Barro Colorado corresponds structurally with Cresson's male and in all other respects, too, except that (1) the legs above the apex of the tibiae are a trifle darker in hue (black rather than dark brown) in the Barro Colorado specimen and (2) there is in the Barro Colorado specimen neither pale, appressed pile on tergite 5 nor dense, appressed, cream-colored pile (described by Cresson as "pale golden yellow") on tergite 6. This pile in the Barro Colorado male is black, but the black appearance is probably a discoloration due to moisture. There are long black hairs fringing the sides of the apex of tergite 5 in Cresson's male as in the male from Barro Colorado.

The female accords closely with Cresson's description of that sex, except that the punctuation of the mesonotum impresses me as moderately dense rather than as sparse; the punctuation accords with that of the male allotype and with that of the male from Barro Colorado.

***Megachile fossoris* Smith**

*Megachile fossoris* SMITH, 1897, 'Descriptions of new species of Hymenoptera in British Museum,' pp. 75-76.

One female, collected Feb. 27, 1933, by H. F. Schwarz.

This specimen runs to *leucocentra* in Schrottky's key to the Brazilian species of *Megachile* (1914, Revista do Museu Paulista, IX, p. 139) and checks up with Schrottky's descriptions of *leucocentra* (1909, Anales de la Sociedad Cientifica Argentina, LXV, primer semestre, p. 236, and 1914, Revista do Museu Paulista, IX, pp. 164-165). In Mitchell's key



to certain of the Neotropical *Megachile* (1930, Trans. Amer. Ent. Soc., LVI) it runs to *fossoris*. Mitchell makes Schrottky's *leucocentra* a synonym of *fossoris*, and Schrottky himself indicated (1920, Revista do Museu Paulista, XII, p. 198) that the name *leucocentra* had better be suppressed. Specimens of *fossoris* that I have been able to examine from localities in Brazil and Costa Rica have the legs fuscoferruginous after the manner of *leucocentra* rather than ferruginous as indicated by Smith for *fossoris*, which may have been slightly aberrant in this respect from the prevailing form. A specimen from Pará in the American Museum collection has been made by Friese the female of *barbatula*, which was described by Smith from the male. Whether or not this association is correct, *fossoris* is an insect of wide distribution, ranging from Paraguay and Brazil into Central America.

### *Megachile curvipes* Smith

*Megachile curvipes* SMITH, 1853, 'Catalogue of hymenopterous insects in British Museum,' I, p. 187.

One male, March 15, 1933, and seven females March 6-24, 1933, collected by H. F. Schwarz.

Smith's type, a male, is not in the British Museum. A close relative of *curvipes* seems to be Smith's *barbatula*. In his description of *barbatula* Smith makes no mention of the structure of the third pair of legs, so characteristic in *curvipes*, but a male from Teffe, Amazonas, which Friese identified as *barbatula*, agrees with Smith's description of *barbatula* in the characters mentioned in that description, and in addition has the small tooth on the hind femora beneath and the curved hind tibiae characteristic of *curvipes*. The male from Barro Colorado lacks the flocus of white at the base of the hind metatarsi mentioned in the description of *barbatula* and shared by the specimen from Teffe, but its two basal abdominal segments are predominantly ferruginous as called for in the description of *barbatula*. The description of *curvipes* reads: "The intermediate tarsi behind and the posterior pair in front have a loose fringe of long white pubescence." In the Barro Colorado male these fringes are not especially developed and there are long dark hairs intermingled with the white. It may be, therefore, that the Barro Colorado insects should rank as a subspecies of *curvipes*, with some of the characters of *barbatula*, but in the absence of the type of *curvipes* it seems preferable not to attempt to draw distinctions.<sup>1</sup>

<sup>1</sup>I am indebted to Mr. Robert B. Benson of the British Museum (Natural History) for kindly examining the type of *Megachile barbatula* Smith. Mr. Benson reports: "It agrees with *M. curvipes* in all the characters you mention. The underside of the middle tibia is produced and terminates at the apex in a stout spine. On the underside of the hind femora, between the middle of the segment and the apex, there is a small tooth and the hind tibiae are also sharply curved." All of these structural characters *M. curvipes* shares with *M. barbatula*.

The females I associate with the *curvipes* male resemble in a number of ways the corresponding sex of *fossoris*, having like it quadridentate mandibles, reddened on the apical half except for the black teeth, a small triangular emargination on the apical middle of the clypeus, rather sparsely punctate clypeus medianly, fulvous hairs on mesonotum and scutellum, and ferruginous tegulae and nervures. They are to be differentiated chiefly through the following characters:

Fasciae on the apices of the abdominal tergites broad, uninterrupted and conspicuous.

The last two sternites and the sides of the third sternite from the end with black hairs.....*fossoris*.

Fasciae on the apices of the abdominal tergites narrow and inconspicuous, overlaid by thin fringes of black hairs. The last three sternites and the sides of the fourth sternite from the end with black hairs.....*curvipes*.

### **Megachile totonaca** Cresson

*Megachile totonaca* CRESSON, 1878, Trans. Amer. Ent. Soc., VII, p. 117.

One female, March 18, 1933, collected by F. E. Lutz; eleven females, Feb. 27–March 24, 1933, collected by H. F. Schwarz; one male, Feb. 27, 1933, collected by H. F. Schwarz.

In describing the female Cresson says: "Pubescence of thorax black, except a slight admixture of white on each side of prothorax above." There is considerable variability in the extent of the white hairs in the case of the Barro Colorado specimens, some corresponding to Cresson's specifications, others having a band of white hairs extending the length of the pronotum, supplemented by a small patch of white hairs on the mesopleura slightly below the tegulae, and sometimes a further patch at the side of the thorax between the tegulae and the axillae. Furthermore, there is variability in the proportion of black hairs to light in the ventral scopa. Some specimens agree with Cresson's description in having "black at sides of basal segments," while others have this black border extending to the apical segments as well. Mitchell (1930, Trans. Amer. Ent. Soc., LVI, p. 166) separates *proserpina* from *totonaca* by the proportion of black hairs to white in their respective ventral scopas. In the discussion of *proserpina* he states (p. 187) that *proserpina* may possibly be only a color variety of *totonaca*.

As the male of *totonaca* has not before been recorded, I offer the following description:

MALE.—Black, like the female, but with the front legs orange-colored except for the coxae and the under side of the trochanters, the middle legs largely orange-colored on the femora and tibiae and lower tarsal joints, and the hind legs, while mainly dark, nevertheless of a dull orange color on the femora and tibiae within and on the lower

tarsal joints. The mandibles deep blood-red except for the black base and black apical teeth.

The patches of white hair contrasting with the otherwise black hair are even more numerous and conspicuous than in the female and as sharply circumscribed. The clypeus, sides of face, and front to just above the median ocellus is covered with rather long creamy-white hairs that conceal or nearly conceal the sculpturing. The dense brushlike patch of straight long hairs on the under side of each cheek near the lower end is snow white in contrast to the short and inconspicuous dull gray hairs on the upper two-thirds of the cheek. On the thorax white hair patches occur below the tegulae, below the hind pair of wings, and just behind the tegulae, but extended over the pronotum and on the lower half of the pleura and under side of the thorax are hairs that are gray. Patches of white hair occur on the lateral extremities of tergites 1-4 but are conspicuous only on tergite 1. The apical tergite is covered fairly densely with appressed pale hairs in addition to a few thin erect hairs and there are pale hair bands on the three apical sternites. The hair on the under side of the front trochanters and femora is yellow, that on the outer surface of the front femora and on the front basitarsi above whitish. Rather spinelike yellowish-brown hairs fringe the anterior margin of the front tibiae. The broad, dense fringe along the posterior margin of the front tarsal joints is a light amber color with the tips of the hairs black. A much shorter fringe of whitish hairs partly overlays this much more conspicuous fringe. The hairs on the middle legs very long on the under side of the joints and for the most part white; the hairs on the under side of the hind coxae, apical part of tibiae, and basal part of femora similarly long and white. The tarsal joints on their inner surface with hairs of light golden color. All the other hairs are black.

The punctuation on the vertex is denser than in the corresponding region of the female, and it is a little denser (although still relatively sparse) also on the mesonotum and scutellum. The mandibles are tridentate, although the middle tooth has a slight irregularity or subdivision (possibly an individual difference). On the basal half of the inferior margin of the mandible is a triangular projection, and the lower end of the cheeks is grooved. The lateral ocelli are about equidistant from the eye and the hind margin of the head. The antennae, when backward extended, do not reach the base of the scutellum. The first joint of the flagellum is barely longer than the pedicel and only about half the length of the second.

The front coxae have two long and rather straight, forward-directed, deep brown spines the tips of which are armed with a needle-fine point. The basitarsus of the front legs is about as long as the front tibia. This basitarsus, like the two succeeding tarsal joints, is expanded scalelike on the anterior side, its pointed extremity ending slightly beyond the base of the third tarsal joint. The expansions of tarsal joints 2-3 are rather long and fingerlike, pointing diagonally downward, with the result that the tip of the "finger" of the second tarsal joint approaches the apex of the third tarsal joint. The long, dense fringe along the posterior margin of the front tarsi has already been referred to. There is a much less developed fringe of diagonally down-slanting, reddish hairs along the anterior border of the front basitarsus.

Considerably smaller than the female, only about 10 mm.

The male seems to be in a number of respects rather like Strand's *Megachile fumicosta*.

***Hypanthidium aureocinctum panamense* (Cockerell)**

*Hypanthidium panamense* COCKERELL, 1913, Annals and Mag. Nat. Hist., (8) XII, p. 105 (Gatun, Canal Zone).

*Hypanthidium panamense* SCHWARZ, 1927, Amer. Mus. Novitates, No. 253, p. 17 (Barro Colorado Island).

*Hypanthidium aureocinctum panamense* SCHWARZ, 1933, Amer. Mus. Novitates, No. 625, pp. 7-9.

Females of this species were collected by F. E. Lutz, Nov. 13, 1923.

***Dianthidium currani* Schwarz**

*Dianthidium currani* SCHWARZ, 1933, Amer. Mus. Novitates, No. 624, pp. 13-16 (Barro Colorado Island).

This is a fairly common bee on Barro Colorado Island, a number of specimens having been taken in the neighborhood of the Laboratory. In the Old World certain Anthidiinae are known to build their nests in empty snail-shells, and it is possible that the bee of similar habit to which Rau refers (1933, 'Jungle bees and wasps of Barro Colorado Island,' p. 185) is *currani*. Rau's bee did not hatch out from the cell in the snail-shell, hence identification could not be made.

***Dianthidium banksi* Cockerell**

*Dianthidium banksi* COCKERELL, 1928, Psyche, XXXV, p. 175 (Barro Colorado Island).

The specimen on which Cockerell's description was based was collected by Nathan Banks on June 20.

***Stelis (Odontostelis) bivittatum* (Cresson)**

*Anthidium bivittatum* CRESSON, 1878, Trans. Amer. Ent. Soc., VII, pp. 116-117.

*Stelis (Odontostelis) bivittatum* SCHWARZ, 1933, Amer. Mus. Novitates, No. 650 (Barro Colorado Island and Balboa, Canal Zone).

One female, March 21, 1933, collected by F. E. Lutz.

***Coelioxys totonaca* Cresson**

*Coelioxys totonaca* CRESSON, 1878, Trans. Amer. Ent. Soc., VII, p. 102.

One female, March 15, 1933, collected by F. E. Lutz. This specimen has been compared with Cresson's type.

***Coelioxys scutigera* Friese**

*Coelioxys scutigera* FRIESE, 1922, Zool. Jahrb. Syst. Geog. und Biol., XLIV, pp. 430, 443.

One female, March 9, 1933, collected by H. F. Schwarz.

The specimen has a largely red tergite 1, contrary to the specifica-

tions of Friese's key, and in length attains at most 13 mm. (the upbent abdomen is hard to measure with accuracy) instead of 16 to 16½ mm. mentioned by Friese. It is possible, therefore, to consider it a local race, although, judging from Friese's description, it is identical in structural characters. *Coelioxys scutigera* was described from northern Brazil.

***Coelioxys laevigata* Smith**

*Coelioxys laevigata* SMITH, 1854, 'Catalogue of hymenopterous insects in British Museum,' II, p. 269.

One male, March 16, 1933, collected by H. F. Schwarz.

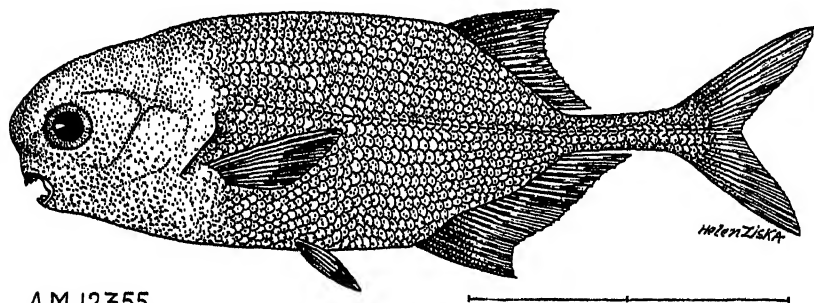
I had tentatively associated the present male with the female of *scutigera*, a somewhat closely related insect, but the characters of the male of *scutigera* noted by Friese are shared only in part by the male before me, whereas there is complete accord between this male and Smith's description of the male of *laevigata*. Before me is also a female *Coelioxys* from San Mateo, Costa Rica, that Friese identified as *laevigata*. Although originally described from Brazil, *laevigata* has been reported by Friese likewise from Paraguay, Bolivia, and Ecuador.

59.7 (67.5)

MORE NEW FISHES FROM THE KASAI DISTRICT OF THE  
BELGIAN CONGO

By J. T. NICHOLS AND F. R. LAMONTE

A number of small fishes collected in 1932 by Callewaert, at Luluabourg in the Kasai District of the Belgian Congo, were overlooked when the remainder of his collection made at that time was studied and reported on.<sup>1</sup> Their examination, just completed, adds 20 forms to the 42 from the locality previously enumerated in The American Museum of Natural History's collections: namely, 5 mormyrids, 4 characins, 2 cyprinids of which 1 is a *Barbus*, 5 catfishes, 3 cichlids, 1 *Anabas*. Our complete



A.M. 12355

Fig. 1. *Marcusenius maculipinnis*, type.

collections from the locality now number 62 species: in percentages, 21 mormyrids, 14½ characins, 35 catfishes, 5 *Barbus*, 6½ cichlids, and 18 otherwise distributed; characins, catfishes and cichlids being somewhat closer to figures for the Congo than were those reported for the incomplete Luluabourg collections in 1933.

The following new species are included: *Marcusenius maculipinnis*, *Heterobranchus platycephalus*, *Euchilichthys boulengeri*, and *Steatocranus elongatus*.

***Marcusenius maculipinnis*, new species**

**SPECIFIC CHARACTERS.**—Anal originating in advance of dorsal. Teeth ⅞; 12 or 14 scales around caudal peduncle; lateral line, 55 to 66. Depth of body, 3 to 3.3 times in standard length; caudal peduncle 3 to 3.5 times as long as deep. Dorsal 17

<sup>1</sup>Nichols and LaMonte, 1933, Amer. Mus. Novitates, No. 656.

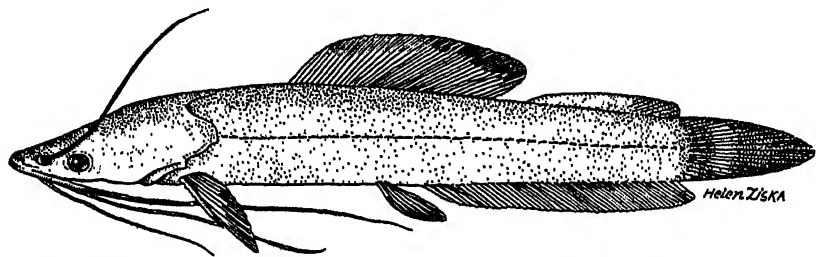
or 18; anal 24 to 25. Caudal peduncle 1.1 to 1.3 in length of head. Front of dorsal and anal and base of caudal, each with a vague, blackish blotch.

**DESCRIPTION OF TYPE.**—Number 12355, American Museum of Natural History; from Luluabourg, Kasai District, Belgian Congo; August 7, 1932; collected by Father R. Callewaert.

Length to base of caudal, 54 mm.; depth in this length, 3; head, 3.5. Eye in head, 4; snout, 6; interorbital, 3.7; width of mouth, 6; greatest width of body, 2.2; length of peduncle, 1.3; its depth, 5; pectoral, 1.2; ventral, 2.3; longest dorsal ray, 2; longest anal ray, 2; caudal lobe, 1.5.

Dorsal rays, 17; anal, 24; scales, 55, about 12 or 14 around caudal peduncle.

Profile rounded with a blunt snout shorter than eye, projecting appreciably beyond the small mouth, the corners of which lie below the front of the eye. Dorsal origin slightly before the middle of the anal base, equidistant from pectoral origin and caudal base. Front of dorsal and anal moderately elevated.



A.M.12356

Fig. 2. *Heterobranchus platycephalus*, type.

Color dusky purplish, broken into small dark spots on the lower surface of head and belly, not appreciably paler below than above. Ill-defined dark blotches on the bases of dorsal and anal in front and across the base of the caudal.

Three other specimens, 53 to 57 mm. in standard length, were taken from the 8th to the 10th of August.

This species resembles *M. adspersus* of the Lower Congo but has fewer fin rays and more scales. It also suggests *fasciaticeps* Boulenger from Leopoldville, but has a relatively larger eye and shorter snout and a more uniformly dusky color.

### ***Heterobranchus platycephalus*, new species**

**SPECIFIC CHARACTERS.**—Adipose fin 1.4 in base of rayed dorsal, separated from it by a distance about equal to  $\frac{1}{4}$  of dorsal base; pectoral  $\frac{1}{2}$  length of head. Head broad and much depressed, its depth 2.6 and its breadth 1.4 in its length, versus 2.4 and 1.6 in an *H. longifilis* of about the same size. Dorsal rays 36; about 15 gill rakers (or less) on anterior arch.

**DESCRIPTION OF TYPE.**—Number 12356, American Museum of Natural History; a single specimen from Luluabourg, Kasai District, Belgian Congo; August 10, 1932; collected by Father R. Callewaert.

Length to base of caudal, 107 mm.; depth in this length, 6.7; head (to end of occipital process), 3.2. Eye in head, 9; snout, 3; interorbital, 2.3; width of mouth, 2.2; depth of peduncle, 3.5; pectoral spine, 3.7; pectoral 2; ventral, 2.7; longest dorsal ray, 2.5; longest anal ray, 4; caudal, 1.7; maxillary barbel, 0.5½. Eye in interorbital, 4.

Dorsal rays, 36; anal, 49.

Head broad and depressed, especially the snout. Peduncular region well compressed. Snout projecting appreciably beyond the curved, inferior mouth. Eye more superolateral than in *longifilis*; the bony top of the head conspicuously rough striate. Maxillary barbel reaching to or beyond the tip of the ventral; nasal barbel beyond the tip of the occipital process; inner mandibular to the pectoral base, and the outer mandibular well beyond its tip. The pectoral spine is distinctly serrate on the outer,

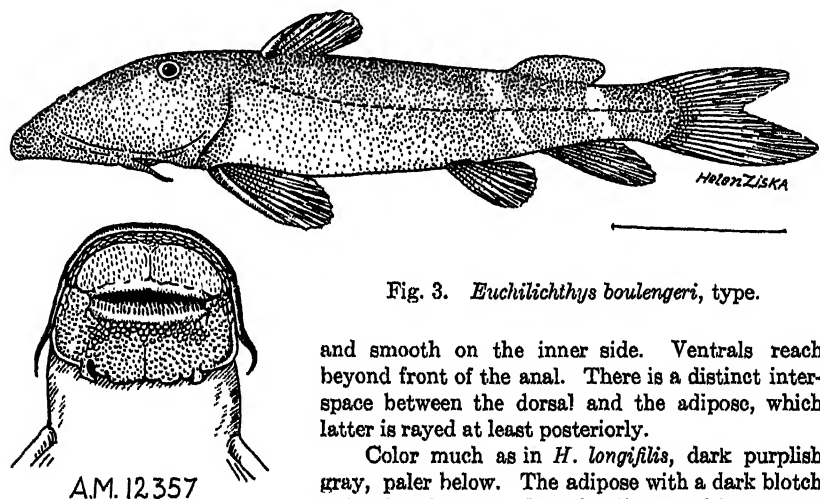


Fig. 3. *Euschilichthys Boulengeri*, type.

and smooth on the inner side. Ventrals reach beyond front of the anal. There is a distinct interspace between the dorsal and the adipose, which latter is rayed at least posteriorly.

Color much as in *H. longifilis*, dark purplish gray, paler below. The adipose with a dark blotch at its tip; the caudal blackish distally with a narrow pale margin and broad, sub-basal, pale crossband. The anal lobe more or less dusky with a pale edge. Nasal and maxillary barbels blackish; the others paler.

#### ***Euschilichthys Boulengeri*, new species**

**SPECIFIC CHARACTERS.**—Depth of body about 5.5 to 6 in length. Eye 8 or 9 times in length of head; 2 or 3 times in interocular width. Base of adipose fin one-half its distance from dorsal. Differs from *royauxi* in larger snout and disc; narrower interorbital (2 or more in snout), shorter dorsal spine (3.2 to 3.6 in head), and color. The pale bands on the caudal region are more distinct, usually two quite definite ones, and the spots on the body are less pronounced or absent.

**DESCRIPTION OF TYPE.**—Number 12357, American Museum of Natural History; collected at Luluabourg, Kasai District, Belgian Congo; August 9, 1932; by Father R. Callewaert.

Length to base of caudal, 95 mm.; depth in this length, 5.7; head, 3. Eye in head, 8.5; snout, 1.5; interorbital, 3; maxillary barbel, 5 or 6; width of head and of



disc, 1.3; depth of head, 2.2; depth of peduncle, 4; its length, 3.7; pectoral spine, 2.3; dorsal spine, 3.6; ventral fin, 2.8; longest anal ray, 2.4; height of adipose, 8; lower caudal lobe (the longer), 1.4.

Dorsal, I, 7; anal, 9.

Body depressed before the ventrals; peduncle compressed; lower surfaces flat; head and snout very broad and flat; interorbital appreciably concave; the disc very wide and its margin extending backward about to under the hind margin of the eye, as far as does the small lateral barbel. Teeth on the lower jaw somewhat coarser than is usual in *E. royauxi*, in about 25 rows from side to side. Dorsal origin about equidistant from end of snout and anal origin; ventral origin nearer that of adipose than dorsal axil; pectorals extending back about halfway to ventral origin; ventrals to anal origin; anal to caudal base. Pectoral and dorsal spines smooth in front, the pectoral appreciably serrate and the dorsal slightly roughened behind. Skin of body villous; lower side of head with less crowded small papillae.

Color rather uniform slaty, the lower surfaces paler, pinkish. A broken pale band diagonally downward and backward from near the front of the adipose; a second more complete band from behind the adipose, and a third indistinct one on the base of the caudal. Fins dark gray, more or less broadly or distinctly margined with paler. Two other specimens are more or less spotted with dark on a paler ground, but less so than *royauxi*.

The following table gives certain measurements of our four specimens of *Euchilichthys boulengeri*, compared with an *E. royauxi*, from Faradje, Belgian Congo.

	<i>E. boulengeri</i>				<i>E. royauxi</i>
	Type				
Standard length.....	97 mm.	95 mm.	89 mm.	77 mm.	94 mm.
Depth in length.....	6.....	5.7.....	5.4.....	6.....	5.7
Eye in interorbital.....	2.7.....	2.7½.....	2.8.....	2.5.....	3
Snout in head.....	1.5.....	1.5.....	1.5.....	1.4.....	1.5
Interorbital in head.....	3.....	3.....	3.1.....	3.4.....	2.5
Width of disc.....	1.3.....	1.3.....	1.4.....	1.4.....	1.5
Length of disc.....	1.4.....	1.6.....	1.6.....	1.5.....	1.6
Dorsal spine.....	3.5.....	3.6.....	3.4.....	3.2.....	2.4
Head in length.....	3.....	3.....	2.8.....	2.7.....	3.2

### *Steatocranus elongatus*, new species

SPECIFIC CHARACTERS.—Depth, 4.3 to 4.4 in standard length. Scales much reduced in size above almost the entire length of the upper lateral line so that there are five or more rows (versus 2½ in *S. gibbiceps*) between its tenth scale and the dorsal.

DESCRIPTION OF TYPE.—Number 12358, American Museum of Natural History; collected August 11, 1932; at Luluabourg; by Father R. Callewaert.

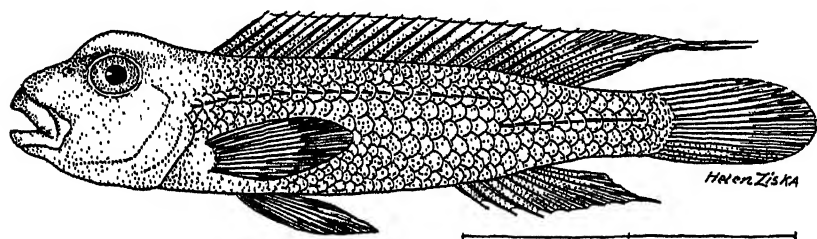
Length to base of caudal, 49 mm.; depth in this length, 4.4; head, 3.5; eye in head, 4; snout, 2.6; interorbital, 4; maxillary, 3; depth of head (not counting crest),

1.5; its width, 2; depth of peduncle, 2.8; its length (from anal axil), 1.9; pectoral 1.4; ventral, 1.2; last dorsal spine, 2.5; longest dorsal ray (filamentous), 1; third anal spine, 2.5; longest anal ray, 1.4; caudal, 1.3.

Dorsal, XX, 8; anal, III, 7; scales, 32 (lateral lines 20+10); 13 or 14 around peduncle.

Head only moderately compressed; lower jaw distinctly included, maxillary not quite reaching to below front of eye; a distinct crest of loose skin on the interorbital. Dorsal origin about over that of the pectoral and slightly before that of ventral; ventral reaching back to or little beyond the tip of the pectoral, somewhat more than halfway to the anal origin; dorsal filament to past the middle of the caudal; caudal rounded, subtruncate. Head, nape, breast, and middle of belly without scales. Scales between most of lateral line (anteriorly) and dorsal much reduced in size.

Color purplish gray, the fins, with the exception of the pectorals, somewhat darker.



A.M.12358

Fig. 4. *Steatocranus elongatus*, type.

Another specimen from Luluabourg, collected on the 29th of August, measures 51 mm. in standard length. In this the ventrals are about the same length as the pectorals and extend a little more than halfway to the anal origin. The depth is a little greater, nuchal crest only slightly indicated, color (in preservative) more yellowish; dorsal, XX, 8; anal, III, 7; scales, 32.

Compared with two specimens of *gibbiceps*, 45 and 54 mm. standard length. These are obviously different, deeper, more compressed with steeper profiles, maxillary extending to under front of eye, etc.

#### ***Leptolamprologus monogramma* Pellegrin**

There are seven specimens sent by Father Callewaert from Luluabourg of this interesting fish recently (1927, Rev. Zool. Afr., XV, p. 55) described by Pellegrin. A female, 58 mm. standard length, with large eggs (about  $\frac{1}{2}$  diameter of eye), has the following color: brownish with a few faint markings above, paler below. A dark stripe from the maxillary through the lower border of the eye to the edge of the preopercle;

another from the corner of the mouth backward, not quite parallel with the first; upper part of opercle more or less dusky. Dorsal and caudal dusky, a submarginal whitish stripe on the dorsal continued backward across the upper part of the caudal; other fins grayish.

In specimens of 60 and 62 mm., in the following table, dorsal and caudal lack the white stripe and caudal membranes are spotted with dusky. The others all agree in color with the one described.

Standard Length	Depth	Head	Eye in Head	D.	A.	Scales
40 mm.	6.5	3.4	4	XX, 9	IV, 8	36
58 mm.	6	3.7	4	XX, 9	IV, 9	35
60 mm.	6.5	3.8	4	XX, 10	IV, 10	37
62 mm.	5.8	3.4	4.4	XX, 10	IV, 9	35
64 mm.	6.5	3.6	4.4	XX, 9	IV, 9	36
68 mm.	6	3.7	4.6	XX, 10	IV, 9	36
68 mm.	6.6	3.7	4.6	XX, 11	IV, 10	35





# AMERICAN MUSEUM NOVITATES

Number 724

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

May 9, 1934

59.57,72 8

## NOTES ON THE SYRPHIDAE IN THE SLOSSON COLLECTION OF DIPTERA

By C. H. CURRAN

The Slosson Collection of Diptera, now in The American Museum of Natural History, is in wretched condition, having been very badly infested with *Dermestes* when received at the Museum. Since its arrival it has been well cared for but, nevertheless, very many of the species are represented by fragments only, and some by nothing more than a pin and label. All the specimens now bear the Slosson Collection label and will eventually be incorporated in the general collection.

During the transfer of the Syrphidae it seems advisable to note the rather numerous misidentifications, since many published records are based upon the specimens. Where determinations are correct no mention is made of the species, but in other cases notes are given.

### *Microdon fuscipennis* Macquart

The specimen from Franconia, N. H., is *globosus* Fabricius.

### *Microdon tristis* Loew

Of the five specimens, not one is in good condition and only three are recognizable: two of these are *cothurnatus* Bigot while one is *tristis*. All are from Franconia, N. H.

### *Microdon* species

Two specimens from Newfoundland, N. J., are *M. ocellaris* Curran.

### *Epistrophe grossulariae* Meigen

One of the specimens from Delaware Water Gap is the typical form, while the other is variety *melanis* Curran.

### *Epistrophe umbellatarum* Schiner

The three specimens are without head, but are evidently *E. mentalis* Williston.

### *Syrphus ribesii* Linnaeus

The four specimens are in poor condition. They are as follows: one *S. rectus* Osten Sacken from Franconia, N. H.; one *S. vitripennis*

Meigen from Franconia, N. H.; two *S. ribesii vittafrons* Shannon from Delaware Water Gap and Richmond, Va.

***Syrphus arcuatus* Fallén**

Three specimens from Franconia, N. H., are *lapponicus* Zetterstedt.

***Baccha notata* Loew**

A female from "Florida" is not *notata*, but is too poor to be identified.

***Mesogramma duplicata* Wiedemann**

One male from Biscayne Bay, Fla., is *planiventris* Loew; one male from Biscayne Bay, Fla., is *florale* Fabricius; two specimens are destroyed.

***Mesogramma parvula* Loew**

The single specimen, from Niagara, N. Y., is a female *Toxomerus geminatus* Say.

***Platycheirus hyperboreus* Staeger**

The single female under this label is *P. erraticus* Curran.

***Platycheirus quadratus* Say**

The male from Newport, Vt. (only the thorax and part of the legs left), is *immarginatus* Zetterstedt and the female, from Franconia, N. H., is the same species.

***Melanostoma obscurum* Say**

The specimen bearing this label is from Richmond, Va., and is a male of a species of *Cartosyrphus* but is too damaged for identification.

***Pipiza pistica* Williston**

One female in perfect condition is *Heringia salax* Loew the other, without head, is a species of *Pipiza*.

***Pipiza puella* Williston**

The female from Franconia, N. H., in *puella*. The male is probably *P. femoralis nigripilosa* Williston.

***Pipiza festiva* Meigen**

Female, Delaware Water Gap, is *P. femoralis* Loew.

**Pipiza pisticoides** Williston

From Franconia, N. H. The female lacks head but is a species of *Pipizella*. The male is *Cnemodon calcarata* Loew.

**Pipiza pulchella** Williston

Both specimens are damaged beyond recognition, but they belong to *Pipizella*.

**Cheilosia petulca** Williston

Franconia and Mt. Washington, N. H. This is *Cheilosia orilliaensis* Curran.

**Cheilosia lasiophthalmus**

A female from Mt. Washington lacks head. It is not *lasiophthalmus* but one of the related species known from the east.

**Cheilosia leucoparea** Loew and **cyanescens** Loew

Both specimens are damaged beyond recognition.

**Cheilosia occidentalis** Williston

A male and female from Mt. Washington, pinned together, are *C. orilliaensis* Curran.

**Neoscasia globosa** Walker

The single male from Franconia, N. H., is *Sphegina flavimana* Malloch.

**Sphegina lobata** Loew

Male, Mt. Washington, and male, Franconia, N. H., are *S. rufiventris* Loew.

Two males from Franconia, N. H., are *S. flavimana* Malloch.

**Sphegina infuscata** Loew

The female from Colorado is correctly named. The female from Franconia, N. H., is *S. rufiventris* Loew.

**Sphegina keeniana** Williston

Neither of the two females is definitely recognizable, but from the remnants one of them appears to be correctly named.

**Temnostoma bombylans** Fabricius

Two males and one female from Mt. Washington are *T. obscura* Loew. Two females from Mt. Washington and one from Franconia, N. H., are *T. trifasciata* Robertson.



**Criorhina verbosa** Harris

The specimen labeled as this species is *Brachypalpus oarus* Walker.

**Xylota ejuncida** Say

One female from Franconia, N. H., is *ejuncida* Say; another female from Franconia is melanic but belongs here.

Male from Franconia is *X. subfasciata* Loew, and a female from Delaware Water Gap is the same species.

**Xylota nemorum** Linnæus

The single male from Watkins Glen, N. Y., is *X. ejuncida* Say.

**Xylota anthreas** Walker

Male and female from Franconia, N. H., are *Myiolepta nigra* Loew.

Another male from Franconia is a species of *Xylota* but lacks head. Perhaps it is  *analis* Williston, but I cannot be sure at present.

**Xylota elongata** Williston

A female from Franconia, N. H., is a rather melanic specimen of *X. ejuncida* Say.

**Xylota analis** Williston

A female from Cherry Harbor, Fla., is evidently the female of *X. viridaenea* Shannon.

**Xylota pigra** Fabricius

Two specimens from Delaware Water Gap are *X. bicolor* Loew, the other three specimens are *X. pigra*.

**Sericomyia slossonae**, new species

Distinguished from described species by the black pilose thorax and abdomen and the narrow yellow abdominal fasciae. Length, 11 to 12 mm.

MALE.—Face creamy yellow, with a moderately broad median stripe that is widest above and reaches the base of the antennae; oral margin and cheeks shining black, the color on the latter extending halfway up the face; in profile almost perpendicular, the tubercle moderately large, not very long, as prominent as the tip of the antennal prominence, the lower part produced well below the lower border of the eye. Frontal triangle black, thickly covered, except immediately above the antennae, by yellowish-white pollen similar to that on the yellow part of the face. Middle portion of face white pubescent, lateral margins and frontal triangle whitish pilose, the latter with a few black hairs above. Vertical triangle black, thinly pale pollinose, with black pile. Occiput grayish pollinose, black pilose on upper half, white pilose below. Antennae reddish, first segment fuscous, the second somewhat piceous red; third segment subrectangular, slightly longer below, slightly broader than long, the corner

rounded, the upper surface convex. Arista reddish, its base piceous, the rays long, sparse, yellow.

Thorax deep shining black, the mesonotum before the suture thinly yellowish pollinose, leaving a geminate median stripe more shining in certain lights. Pile on pollinose portion and narrow upper margin of pleura, yellowish, elsewhere black, not long. Scutellum concolorous with thorax, wholly black pilose.

Femora black, their apices narrowly reddish; tibiae reddish, their middle half or more diffuse brownish; tarsi blackish, the first segment reddish, the second brownish. Hind trochanters without spur.

Wings yellowish anteriorly, the color fading to almost hyaline or cinereous posteriorly. Third longitudinal vein distinctly curved upward beyond the middle of the first posterior cell. Squamae and halteres yellow, the former with yellow fringe.

Abdomen opaque black, the first segment, lateral margins, and apices of the segments increasingly more widely so, shining deep black. Yellow fasciate spots on second segment rather narrowly separated and slightly oblique, the posterolateral corner rounded, the hind margins practically straight; inner ends slightly narrowed, sharply rounded in front, the outer end occupying nearly one-third the length of the segment as it is rather triangularly produced forward. The bands on the third and fourth segments are similar in shape but only slightly widened laterally, nearer the front margin and very narrowly interrupted. Fourth segment half shining. Pile black with the exception of a few hairs laterally on apical segment and most of the ventral hairs.

FEMALE.—Differs only sexually; front dulled with grayish pollen, a broad band at the vertex brownish yellow, another below the middle of front grayish yellow, the frontal pile black. The third yellow abdominal band is not, or only obscurely, interrupted in the middle; on the fourth segment there is a basal yellow fascia that is broadly interrupted in the middle, the spots thus formed tapering to a sharp point at their inner ends. Fifth segment yellow pilose.

Holotype male, allotype female, and another headless female from Franconia, N. H. (Mrs. Slosson).

The male was determined as *chalcopyga* Loew, the female as *lappona* Linné. There is a male in the United States National Museum and another in the Museum of Comparative Zoölogy, Cambridge.

This is the form of which I had seen only males and considered to be the unknown male of *S. serfasciata* Walker. The fact that the female shows no difference in abdominal maculation proves that my previous conclusions were erroneous.

In 1926, R. C. Osburn described a new species related to *serfasciata* which he placed in the genus *Condidea* Coquillett. This genus is hardly tenable, being based upon the presence of spots instead of fasciae on the abdomen and the strong curvature of the third longitudinal vein as well as an allegedly differently shaped abdomen. All the species of *Seratomyia* have the third vein more or less curved, there is no marked difference in the shape of the abdomen, and only the difference in abdominal

maculation remains. On this basis only the genotype of *Condidea*, *lata*, belongs in this genus, the others all being referable to *Sericomyia*.

The species may be separated as follows:

- 1.—Abdomen with only one yellow band ..... *carolinensis* Metcalf.  
Abdomen with two or three yellow or whitish bands, or spots arranged in rows—  
first band sometimes very wide. .... 2.
- 2.—Face without a median black stripe. .... 3.  
Face with a median black stripe. .... 4.
- 3.—Third vein strongly curved into first posterior cell; first pair of spots very large,  
the following bands broken into spots. .... *Condidea lata* Coquillett.  
Third vein nearly straight; face strongly produced downward; abdomen with  
three bands. .... *cynocephala* Hine.
- 4.—Fourth abdominal segment without a crossband; those on the second and third  
distinct; male. .... *bifasciata* Williston.  
Normally three bands; if only two, none on the second segment. .... 5.
- 5.—Yellow band on second abdominal segment twice as wide as the following yellow  
bands. .... 6.  
Yellow band on second segment but little wider than following bands. .... 7.
- 6.—Spots on second abdominal segment narrowed in the middle. .... *sexfasciata* Walker.  
Spots on second abdominal segment with parallel sides. .... *transversa* Osburn.
- 7.—Thorax and abdomen except the fifth abdominal segment in the female, black  
pilose. .... *slossonae* Curran.  
Abdomen extensively yellow pilose in both sexes. .... 8.
- 8.—Scutellum distinctly reddish; femora practically all reddish (Europe).  
*lappona* Linnaeus.  
Scutellum sometimes reddish (usually black); if reddish, the femora over half  
black. .... 9.
- 9.—Spots on the second segment small, often wanting; all the spots small, oblique,  
dashlike, widest medianly; ground color black; scutellum often somewhat  
reddish; male hind coxae with a spur. .... *militaris* Walker.  
Spots on the second segment very distinct, those on the following segments wide  
laterally; hind coxae of male with or without spur. .... 10.
- 10.—Abdominal spots oblique. .... 12.  
Abdominal spots transverse. .... 11.
- 11.—Face produced strongly downward; hind femora of female black, except the  
apices; abdominal bands cut off obliquely behind, transverse in front;  
female. .... *bifasciata* Williston.  
Face not abnormally produced; abdominal bands not oblique behind, scarcely  
wider laterally; hind femora over one-third reddish; fifth segment without  
red hind border. .... *chalcopyga* Loew.  
Face not abnormally produced; abdominal bands but little oblique behind;  
fifth segment with red hind margin (Europe). .... *borealis* Fallén.
- 12.—Hind coxae of male with strong spur on inner posterior side; hind femora chiefly  
black pilose below. .... *calcarata* Curran.  
Hind coxae of male without spur; hind femora pale yellow pilose below.  
*chrysotoxoides* Macquart.

<sup>1</sup>Female not known: probably very similar to *militaris*.

**Helophilus latifrons** Loew

All the specimens, from Franconia, N. H., Richmond, Va., and Delaware Water Gap, are *H. fasciatus* Walker.

**Helophilus glacialis** Loew

The specimen from Mt. Washington is *H. groenlandicus* O. Fabricius.

**Helophilus chrysostomus** Wiedemann

Three specimens, Franconia, N. H., and New York, are *Lejops lunulatus* Meigen.

One female from Franconia, N. H., is *Lejops relictus* Curran and Fluke.



# AMERICAN MUSEUM NOVITATES

Number 725

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

May 11, 1934

---

56.1, 92 (117:78.6)

## A SILICIFIED SHELF FUNGUS FROM THE LOWER CRETACEOUS OF MONTANA

BY G. R. WIELAND<sup>1</sup>

In petrified vegetal structures of varied type, from the simplest of vascular plants up to the highest, and from Devonian times down, fungus threads or hyphae are often noted. Penetrating the tissues of woods of varied type, these parasitic cells may be quite well outlined, following either calcification or silicification. Remarkably well defined fungi are found in the cherts of Middle Old Red Sandstone age at Rhynie, Scotland, now so famous for the beauty of the utterly primitive vascular plants there found silicified in abundance.

Also, there are often seen on fossil leaves traces of fungi, and occasionally casts suggesting fungus forms. But true fossils of the higher types of fungi, or the "toadstools," may hardly be said to exist as well defined forms, unless in exceeding rarity. Nevertheless the fungi are believed to include either actually or in the main mostly very old and unchanged forms, "immortal types." We picture the higher types as present back through the ages, and ascribe the meagerness of the record to the small likelihood of fossilization. But amongst fossils the unawaited or infinitely rare type may at last be found.

Such an unexpected "find" is that of a small but beautifully silicified shelf or bracket fungus found by Mr. Barnum Brown lately while collecting armored dinosaurs in the Cloverly horizon of the Lower Cretaceous along Beauvais Creek on the Crow Indian Reservation, about 40 miles south of Billings, Montana. The locality is near the "Bill Cashen ranch" and yielded some twelve skeletons of dinosaurs of varied form and remarkable type. It is indeed curious to thus see with certainty a mushroom very much as it grew in life on the trees of the forests of those remote dinosaur times. We may assume that the climate was warm, that ancestors of the fig and magnolia were there, and that this fungus grew on the bark of such trees, or perhaps on some conifer.

The common genus *Polyporus* includes the bracket or shelf fungi generally, which are familiar to every one who strolls through the woods.

<sup>1</sup>Osborn Botanical Laboratory, Yale University.

Adhering to stem or bark, the types vary from lobes an inch or two across and perhaps a half inch in thickness (often thinner) up to larger masses several feet across. Many of these types close up their pores with hyphal growth, becoming tough and woody so that they may persist for many years. After all, it may not prove so strange that such a plant could persist and be petrified, and Brown thinks he should be able to find more examples.

The first example of a silicified polypore is in the form of an oval-shaped lobe 5 centimeters long by 3.5 centimeters across and one thick. It is mainly what students of the fungi call in a polypore the "hymenium" or mass of pore-traversed spore-bearing tissue,—the upper cap, pileus or "subiculum" of the original fungus being here either eroded away or not silicified. As a photograph of this small fossil anywhere near natural size would show little of feature, photomicrographs are mainly relied on for illustration and description; except that there is included the much enlarged camera lucida drawing of a single pore in transverse thin section, done by the scientific illustrator, Lisbeth Krause.

Naming a fossil such as is now before us presents certain peculiar difficulties. Firstly, it is not exactly the best form to declare that the type may be included in a living genus, *Polyporus*, since that might mean too much of an extension of the original generic significance; and secondly, it is rather better to use for fossil plants the ending *ites* where there are near resemblances to living types, especially so where the fossil type is of great age. Hence, were there no difficulties of synonymy in the way, the proper generic term would unquestionably be *Polyporites*. Can this generic name be used? *Porites* is a coral.

Now it so happens that just one hundred years ago Lindley and Hutton in their 'Fossil Flora of Great Britain' (Plate 65) described from the shale of a coal pit near the entrance of the vale of Llangollen, Wales, a fossil which they admit may be the scale of a fish but deem more likely to be a *Polyporus*-like fungus. And their argument is rather clever. They point out just such concentric and radiating surface lines as one might well find in some shelf fungus in the vale of Llangollen (which I know) today. Above is seen the "pileus" with the radiating and sub-concentric lineation; while here and there over the surface are dottings which may be "parts of the *hymenium porosum*" as exposed by tears through the smooth upper surface or pileus. Nevertheless, Schimper (Cf. Zittel II) placed the fossil as a fish, *Holoptychius Hibberti* Agassiz,

and added that the *Polyporites Sequoiae* Heer from the Miocene of Greenland "may be a true *Polyporus*."<sup>1</sup>

Would it not in the end tend toward better usage and a closer accuracy if the name *Polyporites* were retained for fossils demonstrably like *Polyporus*, and so used for our fossil? Must good names be thrown away forever just because some one has placed them in some inadmissible relation? Can they never again be given scientific status? Here this much may be seen. In texts generally, the references to the fossil fungi, except in the case of the hyphae of the fossil woods as so freely seen, are very short and guarded both as to type and nomenclature. Hence, to sift the literature through for the fungi would be at present a task that would have to be done virtually unaided by text or catalog. This, owing to the exceedingly precarious chance of finding well defined new types, is a poor situation which ought to be rectified in the simplest possible manner. The best course becomes plain enough. It is to begin over again and use the names standing in near relation to existing counterpart genera; or at least to make sure that before casting any name aside it has actually been rendered unusable. In this way, with care in describing fossil fungi, a nomenclature that the authors of texts and catalogs need not doubt may be gradually brought into use.

Accordingly, the name ***Polyporites browni*** will be used for our fossil, naming it for its discoverer, and with the certainty that this is a very rare and finely silicified polypore.

### ***Polyporites browni*, new species**

#### DESCRIPTION

A new species of polypore fungus from the Lower Cretaceous (Cloverly beds) of Montana, collected by Barnum Brown, 1932. One well preserved specimen, 5×37×50 mm., American Museum catalog number 24123, type. One longitudinal section, 24123-A, through hymenium, showing characteristic longitudinal pores and presence of lateral net of pores, or labyrinthine pore-branching. Two transverse sections, one 24123-B, the other 24123-C; compare with the text-figures 1-8, showing photomicrographs, enlarged views and drawing of type.

I have failed to find embedded and well-stained sections of polypores for close comparison. Accordingly, it is more logical to begin with histologic structure taken just as it is seen, and then pass, though but

<sup>1</sup> 'Flora Fossilis Arctica,' III, Mem. 3, page 7, and Pl. 1, Fig. 1. This fossil is from the Miocene of Netluarsuk, Disco Island. It may actually be an imprint of the upper surface of the cap or subiculum of a polypore with radial and concentric lineation. The specimen is of about the same size as the Montana polypore.



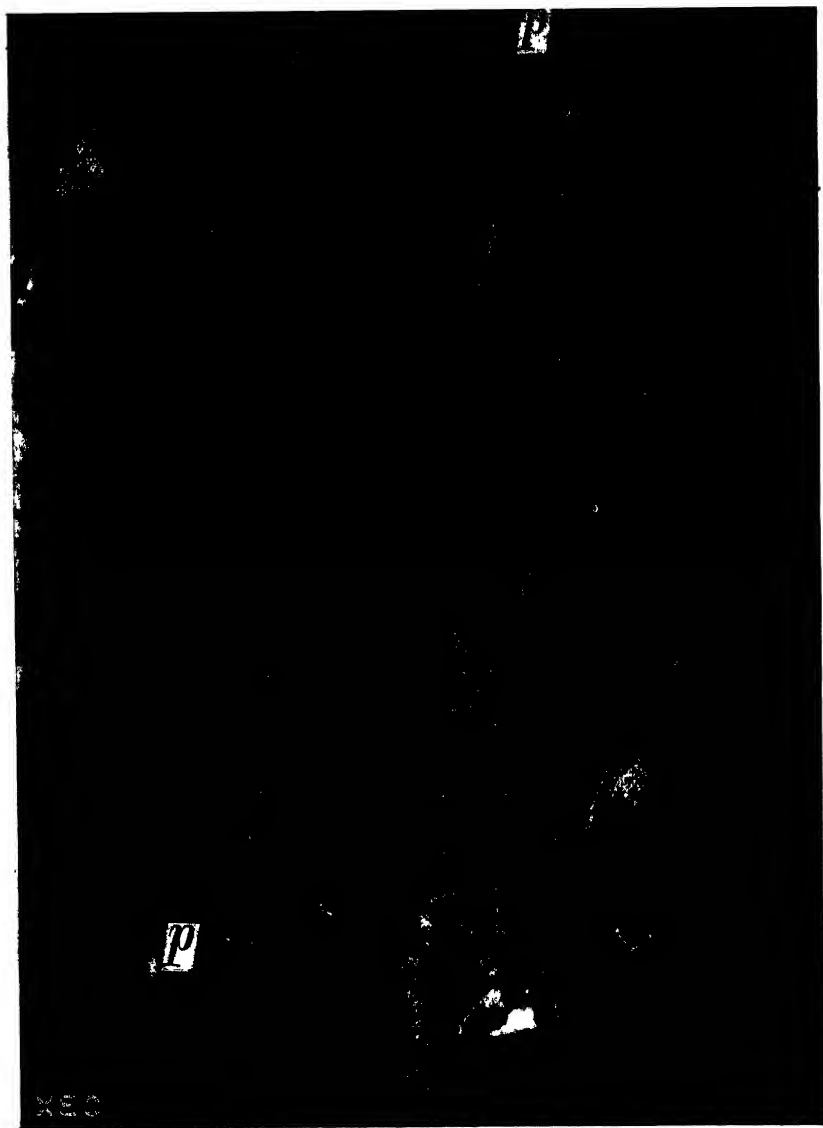


Fig. 1. *Polyporites browni*, n. sp. Type. Amer. Mus. No. 24123-A. Photomicrograph of longitudinal thin section through hymenium, showing characteristic longitudinal pores (*p, p*) and also presence of lateral net of pores, or labyrinthine pore branching.  $\times 80$ .

briefly, to outer form and feature. Figure 1 shows the longitudinal section through the hymenium, enlarged about 80 times. Two of the pores pass quite through with slight evidence of lateral or labyrinthine branching. Only one or two lateral tubes are seen to traverse the broad band of tissue between the pores called the trama (woof). This in polypores is a fine thready or hyphal mat; and in the translucent brown of the thin section itself, as well as in the illustration, a thready mass seems to be present in accord with the definition of the trama.

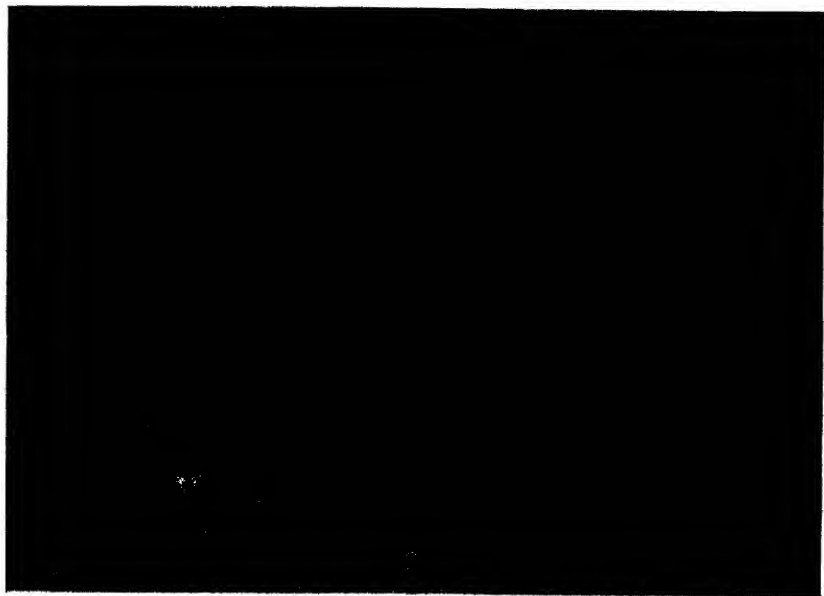


Fig. 2. *Polyporites browni*, n. sp. Type. Photomicrograph showing transverse section through hymenium. Pores unbranched.  $\times 100$ .

While the pores in the main run parallel as in a polypore like the familiar *Boletus* at first sight, study of the illustration shows the presence of various transversely cut lateral pores; and in the thin section it is soon found that there is a main vertical pore series and a minor labyrinthine series, which branches out from it. These lateral pores do not diminish much in size. They are the most unusual or recondite feature of this fossil.

Turning now to photomicrographs, Figs. 2, 3, showing the transversely cut section of the hymenium somewhat more enlarged than the

preceding ( $\times$  about 100), the appearance and mode of pore preservation may be much better understood, especially the branching feature. Apparently the outer pore wall consists of a setal or hyphal thready mass replaced in the course of silicification as a zone of nearly clear quartz in which the darker hyphae are very distinct. Inside this is a somewhat narrower zone of markedly concentric banding, also traversed by the radial threads. The width of this second zone varies much in the different

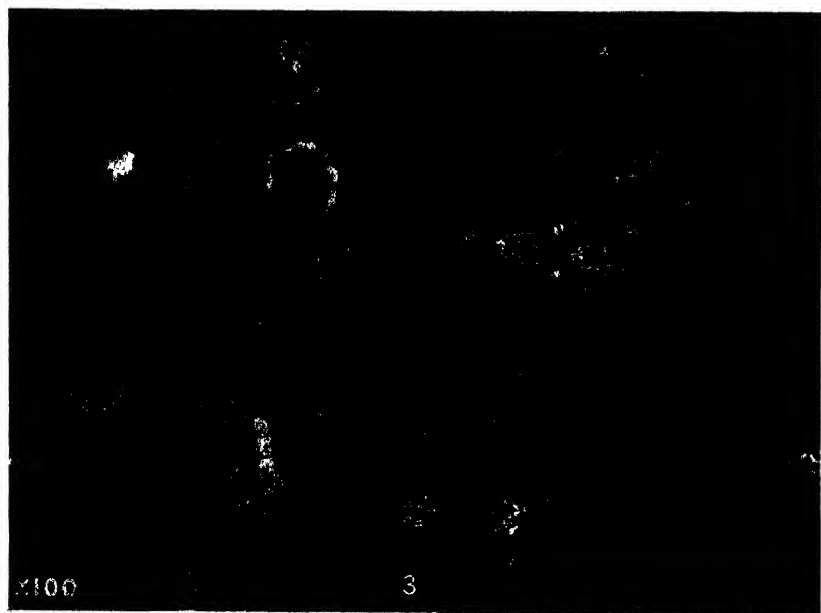


Fig. 3. *Polyporites browni*, n. sp. Type. Photomicrograph showing another transverse section through hymenium at nearly same level below unsilicified cap as preceding section, but traversing an area in which initial pore branching occurs.  $\times 100$ .

pores, and the banding seems to be a feature of petrification, rather than due to actual structure.

The filling of the pores inside the banded zone appears merely as a darker mass, or lesser masses set here and there in indistinct granulation of a very uncertain nature; or else there may be a filling in of quite clear light blue silica. Taken feature by feature these naturally stained sections are objects of great beauty. But in the highly magnified camera

lucida drawing, Fig. 5, of a transversely cut pore traversing the trama, the artist may have drawn too well! For it is scarcely possible to identify the darker inner bodies there noted with actual structure. In the fossil, nothing like basidia, cystidia or spores, which at  $\times 100$  would appear about one millimeter in length, can be noted with certainty. But old sporophores due to leathery texture might last for years, and it

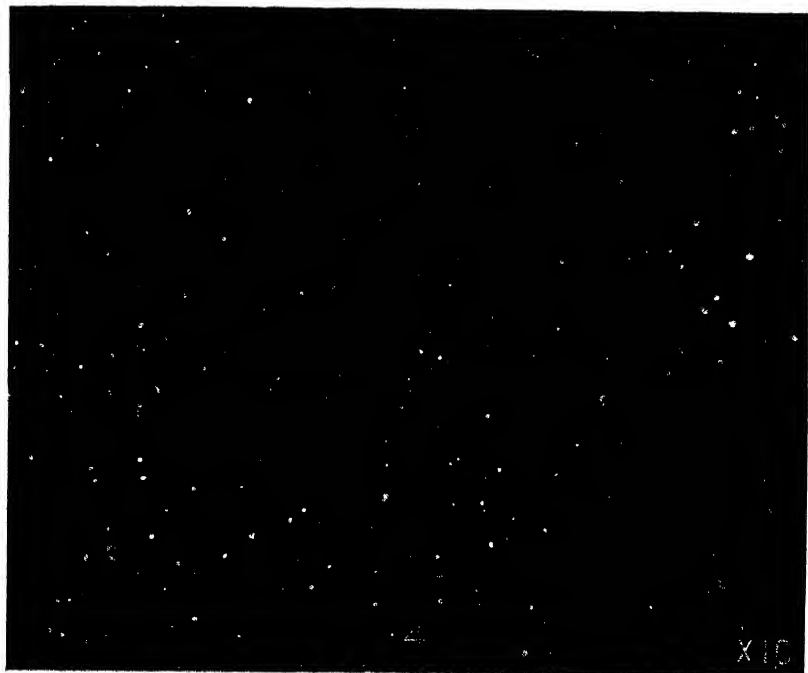


Fig. 4. *Polyporites browni*, n. sp. Type. Photomicrograph showing polished transverse section through hymenium showing manner of pore branching.  $\times 10$ .

may be that some of the features recorded by the artist are due to such sporophores.

That the silicification nevertheless bears a remarkable relation to the original structures is further brought out by comparison of the polished transverse section, photomicrograph, Fig. 4, with the same surface after etching in a 5% solution of hydrofluoric acid as shown by photomicrograph, Fig. 6. On the etched surface the pores are more clearly outlined as the main structures in the hymenium.

Finally, the upper surface of the fossil is shown in Fig. 7, and the lower surface in Fig. 8, magnified ten and five times respectively. It is thus certain that none of the pileus is present, though it should be as

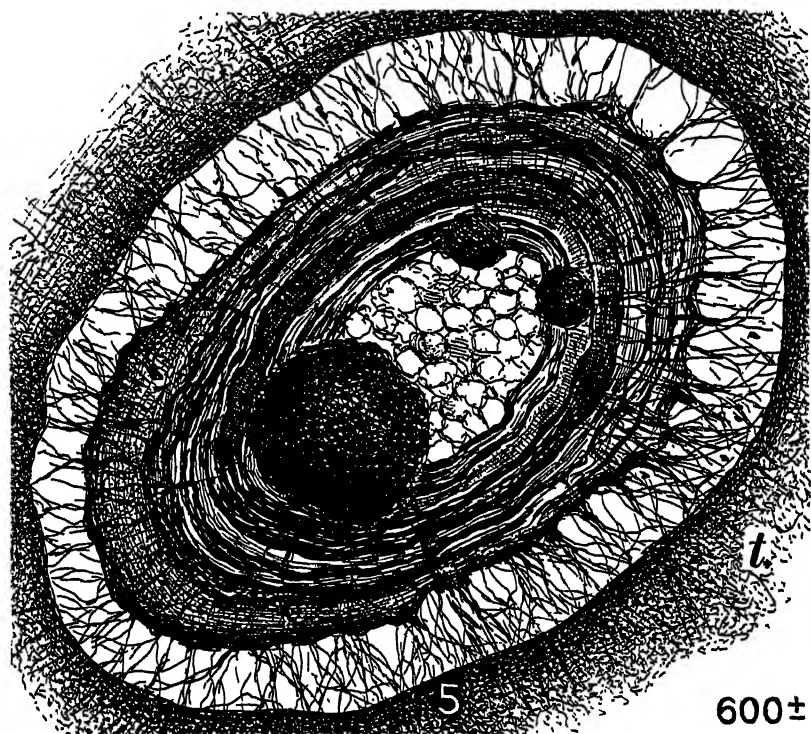


Fig. 5. *Polyporites browni*, n. sp. Type. Camera lucida drawing of transverse section through single pore greatly enlarged. Outside the transparent layer is the tissue of the trama (t). The concentric banding of the inner pore wall is partly due to the manner in which siliceous replacement proceeded. The lighter central granulation appears to be a feature of the siliceous replacement, and the larger dark bodies are not understood as features of the pore.  $\times 600$ .

readily replaced and as resistant to decay as the hymenium. It is possible that the pores aided the infiltration of the solutions which brought on silicification, and that the upper portion of the fossil was more granular and easily eroded.

## SILICIFICATION

Each new instance of the replacement of plant tissues by silica gives an added interest to a process which has gone on in nature throughout geologic time and yet has never been quite satisfactorily reproduced in the laboratory. We see in a fossil like that here illustrated, or in the

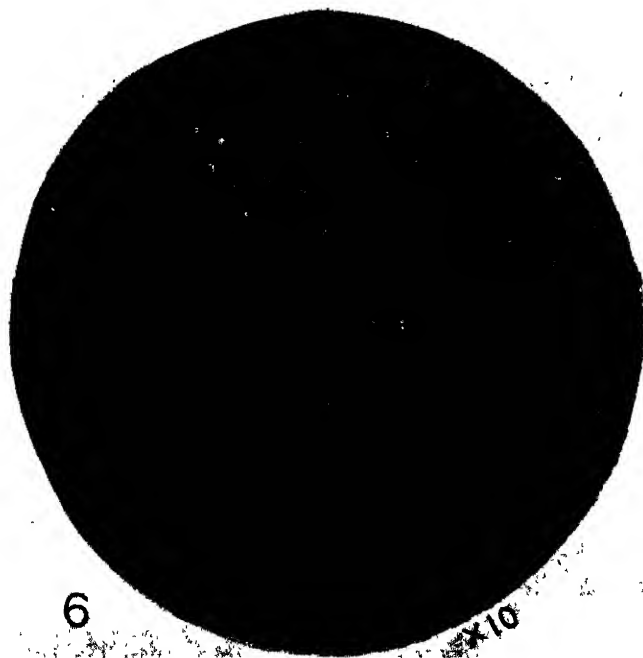


Fig. 6. *Polyporites browni*, n. sp. Type. Amer. Mus. No. 24123-C. Photomicrograph showing etched transverse section through hymenium for comparison with polished section, Fig. 3. This section lies parallel to and about three millimeters beneath the upper hymenial surface as shown in the succeeding Fig. 7.  $\times 10$ .

stem of a petrified oak, or again in a petrified seed or pollen grain or flower, the end result of a chemical reaction as well defined as that which ends in a quartz crystal. It is a result, too, which if it could be hastened and controlled until the opaline stage was reached would have high value in the laboratory, in botanical teaching and demonstration, and in the arts. The initial stages of this process are seen in the kettles

about the Yellowstone. Over thirty years ago I collected there bits of partly mineralized wood and also replaced pine needles. But what is seen is far from analysis and controlled reactions which again and again result in the replacement of logs even ten feet in diameter.

Obviously chemists have not studied this field more closely because the silicification process has not yet touched the arts, no great industries

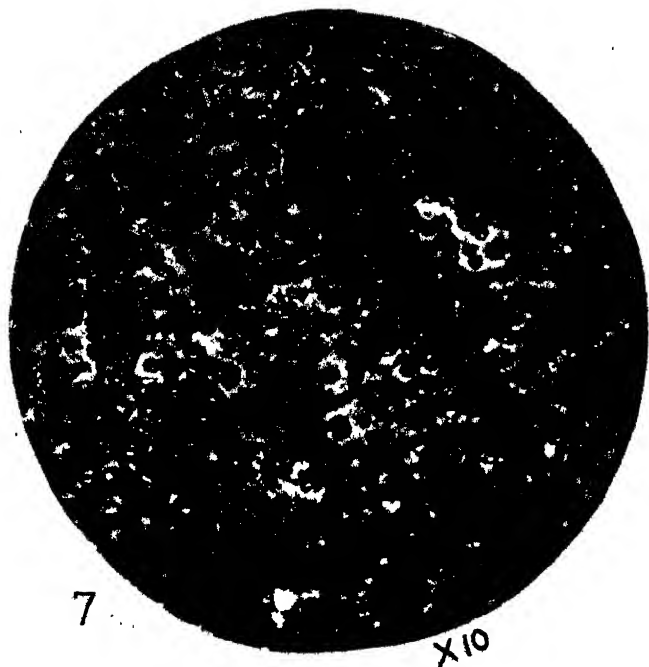


Fig. 7. *Polyporites browni*, n. sp. Type. Photomicrograph showing upper surface of hymenium near cap insertion.  $\times 10$ .

being directly based on the silicic acid series as on the carbon series. But recently the fact that orthosilicic acid may be secured in stable form or relatively so, has been shown by the organic chemist Willstaetter. It is at least evident now that orthosilicic acid in penetrant form reacts on cellulose with deposition of opaline silica, as the first stage in silicification. Also carbon dioxide, especially under pressure, has an important solvent action, so that probably with the aid of heat and pressure in the

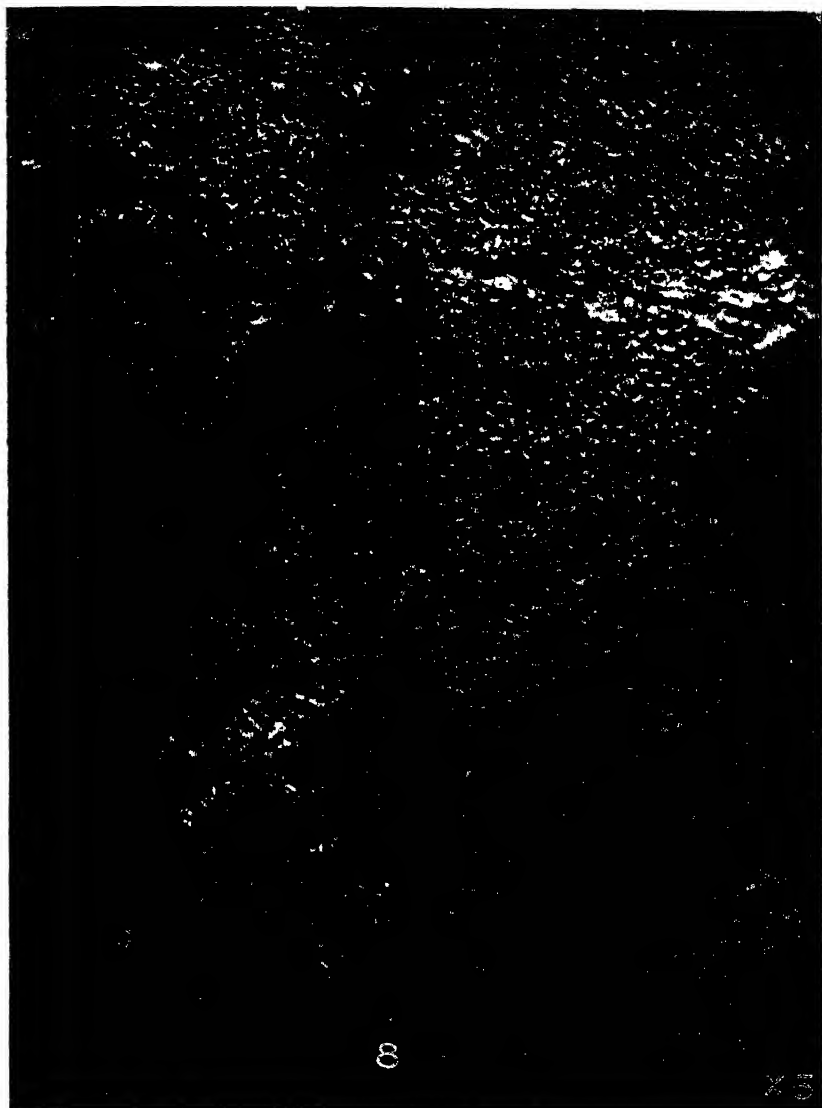


Fig. 8. *Polyporites browni*, n. sp. Type. Photomicrograph showing enlarged view of lower surface of hymenium. There is a highly characteristic mottling due to nodes of hard silica and a series of slight, partly ridge-outlined depressions. The latter feature is just what one may find in a partly desiccated *Boletus* found in the woods any time in the mid- or late summer to-day. Often the pores on one side of a ridge are for a short distance distinctly aligned, showing how easy and simple would be the transition to a gilled fungus type.  $\times 5$ .



presence of a flow of orthosilicic acid, petrification may be brought about. The more stable mono- or orthosilicic acid is produced by dissolving pure sodium silicate in mixed hydrochloric with excess acetic acid. In carrying out experiments looking toward the final solution of the problem of silicification, no more curious plant type could be used than a shelf fungus. Some simple experiments have been begun.

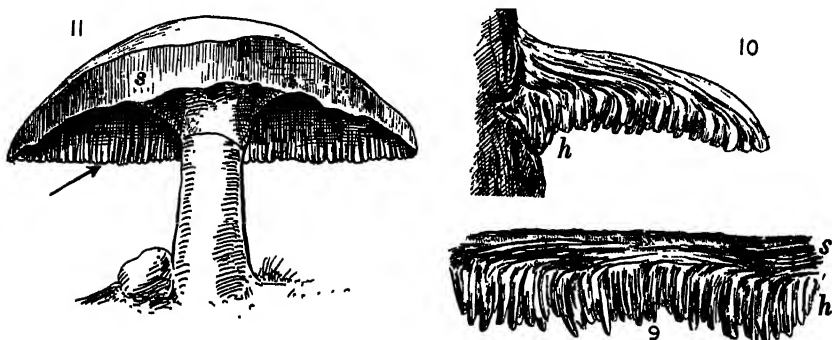


Fig. 9. A common polypore "shelf fungus" of the woods as found growing in abundance on old or fallen trees. Longitudinal view through outer portion of lobe: *h*, hymenium; *s*, subiculum, cap or pileus which is not preserved in the fossil.

Fig. 10. "Shelf fungus" showing tree form of attachment. Longitudinal view, diagrammatic.

Fig. 11. A "stone fungus," *Boletus*. Wholly diagrammatic. The arrow points out the shaded hymenial mass pendant to the upper cap of solid white tissue or subiculum. From the form of the fossil, it is held more likely that it is a "shelf" form rather than one of the stalked "stone" fungi. By way of emphasis, note again that in the fossil it is only the pore-traversed hymenial mass that is preserved, and no part of the cap or subiculum.

Following submission of the foregoing notes to the Editor of *Novitates*, Mr. Brown returned from his field work and further reconnaissance in the Northwest during the past summer. He has learned of what is evidently a second specimen of petrified fungus now amongst the fossils assembled by the famous collector J. B. Hatcher, but not recognized by him as a fungus. This specimen, long in the Carnegie Museum of Pittsburgh, needs therefore to be renoted.

Also, Mr. Brown has now found south of Harlowton, Montana, an additional fungus quite identical with that here described. Associated vertebrates and invertebrates are identical with those of the Cloverly north of the Pryor-Big Horn Mountains. Hence these unusual silicified

shelf fungi must be for their horizon far from rare, and may evidently be found along a considerable range of the Cloverly terranes.

Because of this extended interest, a few of the simplest explanatory drawings, Text Figs. 9-11, are appended to show the relation of the fossil hymenium, as recovered, to the complete fungus as in life, and also to show the simple relation to a closely related stalked form like the common *Boletus*. The relation is in fact so close that, as fossils go, it is conceivable that the petrified form could be more closely related to *Boletus* than to the characteristic shelf fungi. This is somewhat evident from Text Figs. 8-10. There, as the views include the vertical longitudinal section, the position of the hymenium with respect to both types is indicated more directly, and it is seen that in a fossil there would be no absolute certainty that the one type or the other was indicated unless defined or complete outlines were present. But it is the shelf fungi mainly that become woody and lasting, and that might eventually be petrified while yet adherent to tree trunks, perhaps themselves destined to petrification. The fossil form before us is (though not with absolute certainty) considered to be a shelf fungus.

#### CONCERNING GENERIC DIAGNOSIS

In the foregoing pages there is described and even adequately illustrated a vegetal type from the forests where fed the dinosaurs. This is so like types of to-day that one might expect to find not only the generic but even the specific characters yet existent. Indeed, such nearness of type is a most arresting fact, adding a whole chapter to the history of the fungi. Nevertheless, from the fossil side, classification is about all that can as yet be expected. Closer generic or specific diagnoses would here be so arbitrary and imperfect that they could not find application. Such an isolated type finds its own classification, but closer diagnosis begins only when more and varying forms are found. Besides, there must be very many related though as yet unidentified living forms. In the case of these, in fact, as I have been told, even to the initiated, what appears like a *Poria* one day may be thought a *Polyporus* the next! Some students of the fungi do not attempt to identify material over twenty-four hours old, so little lasting are some of the more critical diagnostic features. These may thus better be omitted in the case of this new material "fixed" one hundred million years ago!



# AMERICAN MUSEUM NOVITATES

Number 726

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

May 18, 1934

59.54,4 (7)

## FURTHER NOTES ON AMERICAN SPIDERS

By W. J. GERTSCH

The types of the species diagnosed as new in the following pages are deposited in the collection of The American Museum of Natural History.

### LYCOSIDAE

#### *Lycosa pratensis* Emerton

*Lycosa pratensis* EMERTON, 1885, Trans. Connecticut Acad. Arts and Sci., VI, p. 483, Pl. XLVI, fig. 4.

*Lycosa contestata* MONTGOMERY, 1903, Proc. Acad. Nat. Sci., Philadelphia, p. 649, Pl. XXX, fig. 4.

*Lycosa orophila* CHAMBERLIN AND GERTSCH, 1930, Pomona College Jour. Ent. and Zool., p. 8.

This species is listed by Reimoser as a synonym of *Trochosa robusta* Simon. However, a comparison with European representatives of that and other species shows that it is more closely related to *Trochosa terricola*, of which it is scarcely more than a variety. I have kept it separate because of minor differences that may prove to be constant.

The specific name *orophila* was proposed for a spider that, though agreeing structurally with *Lycosa pratensis*, apparently differed fundamentally in being provided with two teeth on the lower margin of the furrow of the chelicera. Western examples of this species invariably were found to agree in this unusual dental armature. Various European spiders of the genus *Trochosa* (*Trochosina* Simon), with which the species is congeneric, have only two teeth on the lower cheliceral margin.

Variability in the number of teeth on the lower cheliceral margin in the Lycosidae is not uncommon but, within certain limits, the armature is a reliable criterion for the separation of certain genera. The usual variations are the loss of one tooth on each side, the loss of a single tooth on one side, or more rarely the addition of an extra tooth on one or both sides. Large collections of *Lycosa pratensis* Emerton from throughout the United States and Canada are very interesting in regard to the variation of the cheliceral teeth. Generally speaking, it can be rather reliably stated that specimens from the western part of the country have two teeth on the lower margin, while those from the eastern

part have the conventional number. In the northern part of the Mississippi basin, the two types are about equally divided and there seems to be less stability of either formula, many specimens having two on one margin and three on the other. In this connection it is of interest to record the fact that the type of *Lycosa contestata* Montgomery, which is deposited in the collection of The American Museum of Natural History, has four teeth on each of the lower margins of the chelicerae. Three other specimens referred to *contestata* with some question by Montgomery have the conventional three teeth on each side.

The following locality records are given with the object of demonstrating the geographical transition from one type to the other, not as an invariable rule, for some exceptions do occur, but at least to show the tendency in one or the other direction.

DISTRIBUTION.—Two cheliceral teeth on each lower margin. Flagstaff, Arizona, one female. Salt Lake City, Utah (City Creek), August, 1930–1931, six females. Tooele Canyon, Utah, August, 1931, one female. Montpelier, Idaho, July 4, 1928, two females, one male. Nounan, Idaho, August, 1931, three females. Afton, Wyoming, August, 1928, three females. Yellowstone National Park, Wyoming, August 1931–1932, three males, five females (W. E. Gertsch). Comox, British Columbia, female (McDunnough). Edmonton, Alberta, three females. Nepigon Lake, Ontario, one male. Lac des Mille Lacs, Ontario, July, one male. Aweme, Manitoba, August, 1917, one female. Saskatoon, Saskatchewan, one male, one female. Minneapolis, Minnesota, May, 1931–1932, four females. Itasca Park, Minnesota, May 29, 1932, two females. Montreal, Quebec, April 9, 1915, two females (Beaulne). Minaki, Ontario, July 30, one male (Emerton).

Uneven number of marginal teeth, 3–2. Vaudreuil, Quebec, May 27, 1915, one female (Beaulne). St. Jean, Quebec, March 25, 1915, two females (Beaulne). Minneapolis, Minnesota, May, 1931–1932, two females, two males.

Three cheliceral teeth on each lower margin. Montreal, Quebec, April, 1910 and 1915, sixteen females, one male (Beaulne). Vaudreuil, Quebec, May, 1915, one female (Beaulne). Minaki, Ontario, July 30, one male, one female (Emerton). Gaspé coast, 1922, female (Townsend). Fort Coulonge, Quebec, 1918, one male, three females (Beaulne). St. John's, Newfoundland, June 29, 1919, two females (English). Dorval, Quebec, April 20, 1915, female (Beaulne). Ottawa, Ontario, July, male and female. Lac Seul, Ontario, 1919, female (Waugh). Aylmer, Quebec, June, 1915, female (Beaulne). Minneapolis, Minnesota, May, 1931–

1932, seven females, two males. Metlakatla, British Columbia, one male, one female (Keen).

***Lycosa sepulchralis* Montgomery**

*Lycosa sepulchralis* MONTGOMERY, 1902, Proc. Acad. Nat. Sci., Philadelphia, p. 543, Pl. XXIX, fig. 7.

*Lycosa modesta* CHAMBERLIN, 1908, idem, p. 368 (error in determination).

The type of *Lycosa sepulchralis* is a female that differs considerably from the species usually regarded as *L. modesta* Keyserling. It is a heavier species, has much shorter legs and lacks the prominent markings on the carapace that are present in Keyserling's species. It is closely allied structurally to *Lycosa pratensis* Emerton, from which it may be separated by characters of the epigynum. The male type of *sepulchralis* (allotype) has the scopal element of the palpus much smaller than in *modesta* Keyserling.

***Lycosa abdita*, new species**

**Figure 6**

FEMALE.—Total length, 5.00 mm. Carapace 2.86 mm. long, 2.12 mm. wide.

Carapace uniform dark brown in the alcoholic specimen, showing some signs of an indistinct median longitudinal lighter band and side stripes. Sternum, mouth parts and coxae brown. Legs brown, indistinctly annulate. Abdomen uniform black.

First row of eyes as broad as the second, slightly procurved, the medians larger, about one-third of their diameter apart, as far from the laterals. Second row of eyes narrower than the third (26/34), four-fifths of their diameter apart, slightly farther from the eyes of the posterior row. Third row of eyes much narrower than the width of the carapace at that point (34/57), the eyes smaller than those of the second row. Posterior ocular quadrangle broader than long, (34/23). Clypeus equal in height to one-half the diameter of an anterior median eye. Chelicerae with three subequal teeth on the lower margins.

Legs stout, the tibia with 2-2-2 spines beneath, the posterior tibiae with basal and submedian spines above.

Tibia and patella I, 1.92 mm.

Tibia and patella IV, 2.50 mm.

TYPE LOCALITY.—Female holotype from Gainesville, Florida.

This interesting species is represented by a single female specimen in poor condition. It belongs to the group for which the name *Trochosa* is used by some European authors and agrees well in structure with *Lycosa sepulchralis* Montgomery and *L. pratensis* Emerton. The epigynum differs considerably from that organ in both those species, as shown by the figure. The median septal piece is elongate, not much expanded, and the transverse portion is very narrow.

***Lycosa persimilis* Banks**

*Lycosa concolor* BANKS, 1898, Proc. California Acad. Sci. (3) I, p. 269, Pl. xvi, fig. 25 (not *Lycosa concolor* Kroneberg, 1875).

*Lycosa persimilis* BANKS, 1898, idem, p. 270, Pl. xvii, fig. 2.

*Lycosa concolor* CHAMBERLIN, 1924, idem, (4) XII, p. 672, Figs. 115 and 116.

***Lycosa minnesotensis*, new species****Figure 2**

MALE.—Total length, 7.30 mm. Carapace, 3.66 mm. long, 2.66 mm. wide. Abdomen, 3.66 mm. long, 2.13 mm. wide.

Cephalothorax evenly covered with appressed black and white hairs, the pars cephalica provided with a few spines, those on the clypeal margin longer. Carapace black in color, with a median longitudinal light band that begins at and is scarcely as wide as the last eye row, is weakly constricted a third of its length back, and then continues, narrowing slightly, to the caudal margin. Sides of the carapace with a submarginal, narrow, dentate, lighter band as wide as the marginal black band. Sternum dark; the labium, endites, and coxae light brown. Integument of legs light brown, but the joints are heavily maculate and annulate in black, the covering consisting of numerous spines and black and white hairs. Abdomen black, heavily clothed with appressed hairs, their color corresponding to the pattern, medially with a longitudinal lighter band that continues the length of the abdomen above, is narrowed caudally where it encloses paired yellow spots. Venter lighter.

First row of eyes five-sevenths as wide as the second, slightly procurved, the medians separated by scarcely a diameter and a little nearer the subequal laterals. Second row of eyes seven-ninths as wide as the posterior row, separated by more than a diameter ( $5/4$ ) larger than the eyes of the last row in the ratio of 6:5. Posterior eyes separated by a little more than three diameters, one and one-half diameters from the eyes of the second row. Quadrangle of posterior eyes broader than long ( $46/34$ ). Clypeus as high as the diameter of an anterior median eye. Chelicerae armed with three teeth on the lower margin, the distal one considerably smaller.

Legs moderately stout, the tibiae and metatarsi with 2-2-2 spines beneath, the last pair apical, the last two tibiae with a stout basal and median spine above.

Tibia and patella I, 3.75 mm. long. Tibia and patella IV, 4.13 mm. long. Palpus as in *Lycosa avida* Walckenaer.

FEMALE.—Total length, 10.00 mm. Carapace, 4.23 mm. long, 3.16 mm. wide. Abdomen, 6.00 mm. long, 4.00 mm. wide.

The female agrees in structure and color with the male but the dorsal longitudinal streak on the abdomen encloses a basal darker hastate marking that runs half the length above. Five pairs of light spots are usually present laterad of the median light band.

Tibia and patella I, 3.66 mm. long. Tibia and patella IV, 4.13 mm. long. Epigynum as figured.

TYPE LOCALITY.—Male holotype, female allotype, and many paratypes of both sexes from the sand dunes near Minneapolis, Minnesota, April 27, 1932 (Gertsch collector); female paratypes from Medicine Hat, Alberta, June, 1930 (Carr collector); female paratype from Twin Falls, Idaho, August, 1931 (D. E. Fox collector).

This species is readily separated from *Lycosa avida* by differences in the female copulatory organs. The eyes of the first row are subequal in *minnesotensis* but in *avida* and *mimula* the laterals are somewhat smaller. In color pattern this species more closely approximates *mimula*, but in the latter form the cephalothoracic light bands are evenly margined rather than dentate.

***Lycosa mimula*, new species**

MALE.—Total length, 7.32 mm. Carapace, 3.56 mm. long, 2.73 mm. wide; Abdomen, 3.76 mm. long, 2.43 mm. wide.

Cephalothorax closely clothed with black and white hairs, their distribution agreeing well with the chromatism of the color pattern, the clypeal margin with long black spines. Carapace dark brown, with a median longitudinal light brown band that begins just behind the posterior eyes and is as wide as the interval between them, and continues to the caudal margin with nearly parallel sides. Sides of the carapace brown, the margins dark, with a submarginal straight light band as wide as the brown margin. Eye area brown, medially with a narrow linelike streak of white hairs that ends at the anterior row. Sternum, labium, and endites yellowish brown, the legs little darker and indistinctly annulate on the tibiae and metatarsi. Abdomen gray on the sides, medially with a longitudinal light band enclosing a darker basal hastate maculation. Venter light yellowish-brown.

First row of eyes five-sevenths as broad as the second, the eyes slightly procurved, the medians separated by scarcely a diameter, somewhat nearer the smaller laterals. Second row of eyes seven-eighths as wide as the posterior row, separated by two-thirds of a diameter, larger than the posterior eyes in the ratio 15:11. Last row of eyes separated by about three diameters, half as far from the eyes of the middle row. Quadrangle of dorsal eyes about as long as broad in the ratio 37:40. Clypeus as high as the diameter of an anterior median eye. Chelicerae with three subequal teeth on the lower margin.

Legs rather slender, the tibiae and metatarsi with 2-2-2 spines beneath, the last pair apical, the posterior tibiae with a stout basal and median spine above.

Tibia and patella I, 3.80 mm. long. Tibia and patella IV, 4.23 mm. long. Palpus as figured.

TYPE LOCALITY.—West of Denver, Colorado, September 17, 1931 (Gertsch collector); male holotype in the collection of The American Museum of Natural History.

*Lycosa scalaris* (Thorell) has long been synonymized with *avida* and there seems to be no good reason to believe it has not been correctly placed. In Thorell's diagnosis the venter is described as being black, and the lateral light bands on the carapace as marginal. Neither of these points is true for the form described above, and they are both more or less constantly characteristic of *Lycosa avida* Walckenaer.



***Lycosa watsoni*, new species**

## Figure 7

FEMALE.—Total length, 9.82 mm. Carapace, 4.60 mm. long, 3.80 mm. wide.

Cephalothorax sparsely covered with short brown hairs, the clypeus with four long spines. Carapace brown, medially with a lighter yellow band that goes forward between the third eye row, and at that point is bisected by a narrow black streak from the dark eye area. Median band somewhat expanded behind the third eye row, narrowed caudally. Sides with a submarginal light band and a marginal broken black stripe. Sternum with a dark central maculation. Mouth parts and coxae infuscated, the legs dark brown, the femora somewhat mottled, the distal joints lightened. Dorsum of abdomen black, basally with a pale median spear mark, the sides dark, the venter lighter.

First row of eyes narrower than the second (35/47), distinctly procurved, the medians slightly larger, the eyes equidistantly spaced, scarcely a radius apart. Eyes of the second row less than a diameter apart (12/17). Third row of eyes narrower than the carapace at that point (69/86), smaller than the eyes of the second row. Posterior ocular quadrangle broader than long (69/44). Chelicerae with three teeth on the lower margins.

Legs moderately stout, the tibiae with 2–2–2 spines beneath, the last pair apical, the last two tibiae with stout basal and submedian spines above.

Tibia and patella I, 4.80 mm.

Tibia and patella IV, 5.50 mm.

Epigynum as figured.

TYPE LOCALITY.—Female holotype from Valdosta, Georgia, July 20–21, 1916 (F. E. Watson).

This species is closely related to *Lycosa modesta* (Keyserling) which differs mainly in characters of the epigynum. The median septal piece of this organ is much more expanded distally than in Keyserling's species and the transverse element is decidedly broader. Most of the specimens of *L. modesta* that I have seen lack the median basal lighter marking on the dorsum of the abdomen, and the venter is darker. The marginal dark band on the carapace is broken in *watsoni*, which is not true in *modesta*.

***Lycosa helluo* Walckenaer**

## Figure 3

FEMALE.—Total length, 9.00 mm. Carapace, 5.00 mm. long, 3.65 mm. wide.

Cephalothorax clothed with short black hairs, the clypeal margin with several long spines and other smaller ones on the sides of the pars cephalica. Eyes on a black field. Carapace brown, medially with a bright yellowish brown stripe that goes forward slightly farther than the third eye row, is expanded just behind the eyes to nearly the width of the second row, and then abruptly narrows caudally. Sides with broad light submarginal bands and a very narrow marginal black seam. Sternum, mouth parts, coxae, and legs uniform light yellowish brown. Dorsum of abdomen with a black hastate figure at the base that is margined by yellow. Sides of the abdomen black, the venter light.

First row of eyes narrower than the second (38/44), slightly procurved, the eyes equidistantly separated by less than the radius of the larger medians. Eyes of the second row about two-thirds of a diameter apart. Posterior row of eyes broader than the second (56/44), much narrower than the width of the carapace at that point (56/90). Posterior eye quadrangle much broader than long (56/42). Clypeus equal in height to the diameter of an anterior median eye. Chelicerae with three teeth on the lower margins.

Legs moderately stout, the tibiae with three pairs of rather small spines beneath, the last two tibiae with basal and submedian spines above.

Tibia and patella I, 4.60 mm.

Tibia and patella IV, 5.20 mm.

DISTRIBUTION.—I have seen this pale variety of *Lycosa helluo* only from Georgia and Florida.

The broad, pale, submarginal stripes on the carapace will distinguish this variety from *Lycosa modesta*, *watsoni* and *avida*. The conventional *avida* markings on the venter are lacking and the sternum is without the median dark maculation that is always present in the other species. The median septal piece of the epigynum is only slightly expanded.

#### *Lycosa commota*, new name

*Lycosa inornata* GIEBEL, 1863, Zeitschr. Gesamm. Naturwiss., XXI, p. 313 (not *Lycosa inornata* Blackwall, 1862).

*Lycosa giebelsi* PETRUNKEVITCH, 1911, Bull. Amer. Mus. Nat. Hist., XXIX, p. 559 (not *Lycosa giebelsi* Pavesi, 1873).

#### *Lycosa illicita*, new name

*Lycosa uncata* CAMBRIDGE, 1902, 'Biol. Centrali-Americana,' Araneidea, II, p. 328, Pl. xxxi, fig. 22 (not *Lycosa uncata* Thorell, 1877).

#### *Lycosa gulosa* Walckenaer

*Lycosa gulosa* WALCKENAER, 1837, 'Histoire naturelle des Insectes Aptères, I, p. 338.

*Lycosa kochii* EMERTON, 1885, Trans. Connecticut Acad. Arts and Sci., VI, p. 485, Pl. XLVI, fig. 6 (not *gulosa* Walckenaer).

*Lycosa nigraurata* MONTGOMERY, 1902, Proc. Acad. Nat. Sci., Philadelphia, p. 564, Pl. xxx, fig. 53.

*Lycosa purcelli* MONTGOMERY, 1902, idem, p. 566, Pl. xxx, figs. 30 and 31.

Walckenaer's description of this species is so brief that the propriety of using his name is to be questioned. The following two species were synonymized with *gulosa* in 1908, but a study of more material, including the types, convinces me that they are distinct. *Lycosa gulosa* is common in the northern part of the United States but has not been collected west of the Rocky Mountains.

***Lycosa pulchra* (Keyserling)**

*Tarentula pulchra* KEYSERLING, 1876, Verh. k.k. zool.-bot., Gesell., Wien, XXVI, p. 628, Pl. I, figs. 13 and 14.

*Lycosa insopita* MONTGOMERY, 1904, Proc. Acad. Nat. Sci., Philadelphia, p. 280, Pl. XVIII, figs. 3 and 4.

This fine species has been collected only in Texas and Florida but no doubt will be found in other southern States.

***Lycosa euepigynata* Montgomery**

*Lycosa euepigynata* MONTGOMERY, 1904, Proc. Acad. Nat. Sci., Philadelphia, p. 279, Pl. XVIII, figs. 1 and 2.

The types of this species and *Lycosa insopita* are in the collection of The American Museum of Natural History. Both were described from Texas.

***Arctosa furtiva*, new species****Figure 4**

MALE.—Total length, 4.50 mm. Carapace, 2.40 mm. long, 1.67 mm. wide. Abdomen, 2.30 mm. long, 1.50 mm. wide.

Cephalothorax provided with a few black hairs in the eye region and on the clypeal margin, and several inconspicuous erect hairs on the midline. Carapace black, smooth and shining. Sternum yellow, infuscated, the mouth parts and coxae yellow. Integument of the legs dirty yellow, the joints annulate in black as follows: femora with basal, median, and distal rings, the patellae with a single median ring, and the tibiae with a basal and a distal black ring. Distal joints showing slight traces of black annulae. Dorsum of the abdomen black, with a pair of large yellow maculations at the base and smaller spots behind. Venter gray.

Eyes occupying one-fifth of the length of the carapace. First row as broad as the second, very weakly procurved, the medians a radius apart, half as far from the slightly smaller laterals. Clypeus equal in height to the diameter of an anterior median eye. Second row of eyes narrower than the third (17/22), the eyes separated by three-fourths of a diameter, a little farther from the smaller eyes of the third row. Posterior eye quadrangle broader than long (22/18). Chelicerae with three subequal teeth on the lower margin.

Legs stout, the second tibiae with 1-1-2 spines, the others with 2-2-2 spines beneath, the metatarsi with three pairs. First two tibiae unarmed above, the last two with a basal bristle and a submedian spine.

Tibia and patella I, 1.70 mm. long.

Tibia and patella IV, 2.00 mm. long.

Palpus as figured, practically identical with that of *Arctosa funerea* (Hentz). Distal apophysis of the bulb longer than in *A. absoluta*, new species.

FEMALE.—Total length, 4.25 mm. Carapace, 2.15 mm. long, 1.50 mm. wide. Abdomen, 2.10 mm. long, 1.60 mm. wide.

Coloration and structure as in the male. Epigynum identical with that organ in *Arctosa funerea* and *noctuabunda*.

TYPE LOCALITY.—Male holotype, female allotype, and immature paratype from Lake County, Florida, November 4, 1933, and an immature female paratype from Sugarfoot, near Gainesville, Alachua County, Florida, September 3, 1933, collected by Mr. Howard K. Wallace, who has generously given the types to The American Museum of Natural History.

This interesting little species has its nearest relatives in *Arctosa funerea* and *chamberlini*. It agrees with the latter species in having the femora banded, but is different in eye relations and palpus. The palpi of *funerea* and *furtiva* are practically identical but, when the two species are placed side by side, several important structural differences are apparent. The cephalic portion in *furtiva* is very broad, the last eye row occupying at that point a little more than half the width (22/38). In *funerea* the cephalic portion is much narrower and the third eye row is over two-thirds (23/30) of the greatest width. The first row of eyes is much more strongly procurved in *funerea* and the femora are invariably dark, never annulate in black and white.

#### *Arctosa absoluta*, new species

##### Figure 1

MALE.—Total length, 4.25 mm. Carapace, 2.31 mm. long, 1.59 mm. wide. Abdomen, 2.00 mm. long, 1.10 mm. wide.

Cephalothorax provided with a few erect black hairs on the midline and some gray hairs in the eye area, otherwise smooth. Carapace yellow, with two irregular black bands above and a narrow marginal black seam; the eye quadrangle black. Sternum, mouth parts, and coxae yellow, sparsely clothed with black hairs. Legs concolorous with the sternum, the last pair with very faint dark rings, thickly clothed with black hairs and long spines. Abdomen yellow beneath, the dorsum with a median longitudinal light band, the sides with large black maculations that form lateral bands.

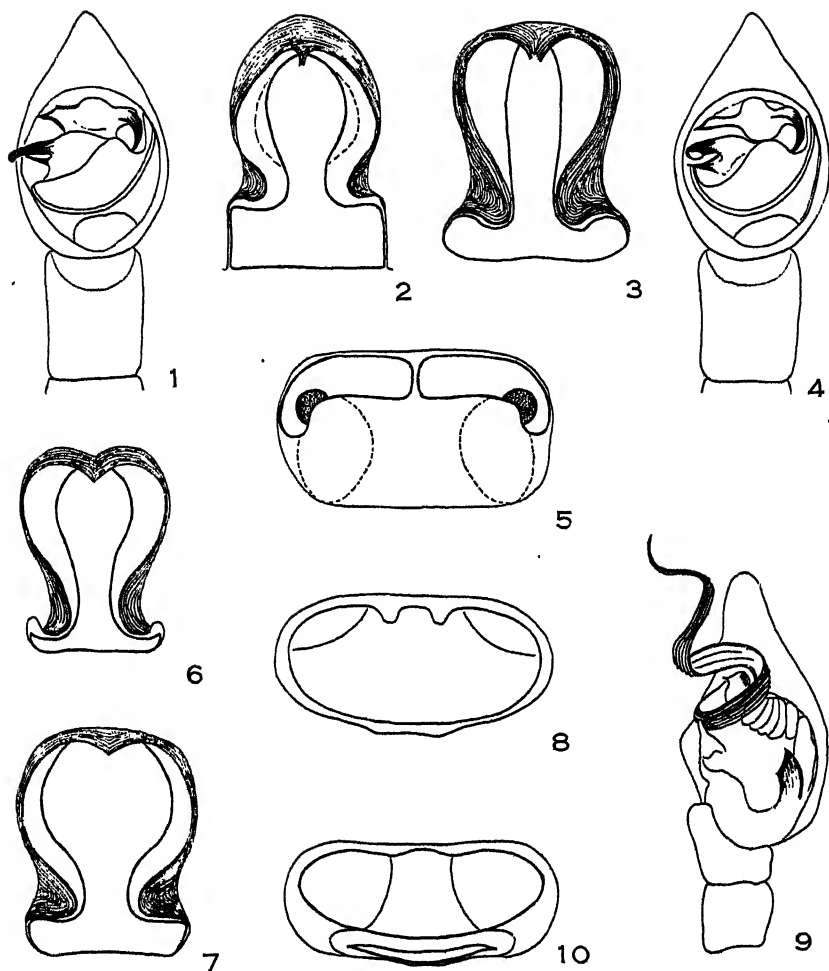
First row of eyes slightly narrower than the second, very weakly procurved, the medians separated by scarcely a radius, nearer the smaller laterals. Clypeus equal in height to two-thirds the diameter of an anterior median eye. Second row of eyes four-fifths as wide as the third row, the eyes large, separated by three-fourths their diameter from each other, a little more than a diameter from the eyes of the third row. Quadrangle of posterior eyes a little broader than long. Chelicerae with three teeth on the lower margin.

Legs stout, the first, third, and fourth tibiae with 2-2-2, the second tibia with 1-1-2 spines beneath, the metatarsi with 2-2-2 spines beneath. The first two tibiae unarmed above, the last two with a basal bristle and a submedian spine.

Tibia and patella I, 1.75 mm. long.

Tibia and patella IV, 2.20 mm. long.

Palpus as figured. Bulb and apophyses of the *Allocosa* type, the scopus a heavily sclerotized, black, curved process directed ventrad, at the base of which is a fine spine. Distal apophysis a short stout spur.



#### PALPI AND EPIGYNA

- Fig. 1. *Arctosa absoluta*, new species.      Fig. 5. *Agelena idahvana*, new species.  
 Fig. 2. *Lycosa minnesotensis*, new species.      Fig. 6. *Lycosa abdita*, new species.  
 Fig. 3. *Lycosa helluo* Walckenaer.      Fig. 7. *Lycosa watsoni*, new species.  
 Fig. 4. *Arctosa furtiva*, new species.      Figs. 8-9. *Agelena barrowsi*, new species.  
 Fig. 10. *Agelena aperta*, new species.

TYPE LOCALITY.—Male holotype from Edinburg, Texas, collected by Mr. Stanley Mulaik.

This species differs from *Arctosa funerea*, *chamberlini* and *furtiva*, to which forms it is closely related in structure, in the unbanded legs, in having the light carapace distinctly striped in black, and in small differences in the character of the scopus and distal apophysis of the bulb of the male palpus.

#### PISAURIDAE

##### *Dolomedes pinicola* (Hentz)

*Micrommata pinicola* HENTZ, 1850, Jour. Boston Soc. Nat. Hist., VI, p. 287, Pl. x, fig. 14.

*Teippus lamprus* CHAMBERLIN, 1924, Proc. U. S. Nat. Mus., LXIII, p. 28.

#### SALTICIDAE

##### *Peckhamia idahoana*, new species

Figures 11 and 12

MALE.—Total length, 2.76 mm. Carapace, 1.32 mm. long, 0.80 mm. wide. Abdomen, 1.42 mm. long, 0.80 mm. wide.

Integument of the carapace almost completely devoid of hairs or spines, the frontal margin with a few short black spines, and a few white scales at the position of the median suture. Carapace nearly black, with a purplish luster that is due to tiny, iridescent scales, the eye tubercles darker. Under parts of the cephalothorax and the legs dark to light brown, the last two pairs with narrow black side stripes. Abdomen glistening black, a white transverse band at the constriction of the abdomen, the venter black.

Carapace flat above, the sides almost vertical, the posterior declivity beginning just behind the last eye row and dropping to the caudal margin. Area of the eyes occupying nearly three-fourths of the total length of the carapace. First row of eyes recurved, a line along the upper margin of the medians cutting the upper third of the laterals, the medians much larger than the laterals (8/4), equidistantly spaced. Second row of eyes slightly narrower than the first, half as far from the anterior lateral as from the posterior eye. Third row of eyes submarginal, broader than the first (28/25), the eyes subequal. Quadrangle of posterior row and the anterior laterals slightly longer than broad (30/28) but apparently much more so. Clypeus one-fifth as high as the diameter of an anterior median eye.

Leg formula 1423, the first leg considerably enlarged and much longer, the patella and tibia thickened, four-fifths as long as the carapace, the tibia armed beneath with 2-2-2 spines, the distals minute, the metatarsus with two pairs. Chelicerae with a single simple tooth on the lower margin. Sternum suboval, the labium broader than long, about a third as high as the endites. Abdomen with a strong constriction one-third of the length back, the sides otherwise subparallel, the caudal margin rounded.

Male palpus heavy, the patella a little longer than the tibia, which is armed with a slightly curved, black spur. Bulb considerably expanded, the embolic portion heavy at the base, the embolus proper a heavy curved spine.

The immature female allotype (total length, 2.40 mm.) agrees structurally with the male.

TYPE LOCALITY.—Male holotype, paratype and female allotype from Hollister, Idaho, May 20, 1931 (D. E. Fox).

This interesting new *Peckhamia* differs from the other species from the United States in having a simple, rather than a compound tooth on the lower cheliceral margin. Moreover, it differs from *Peckhamia picata* and *americana*, in the longer eye quadrangle, which occupies three-fifths of the length of the carapace. In many respects it is nearer *P. scorpionia* but has a simple tibial apophysis.

### *Phidippus altanus*, new species

#### Figure 13

MALE.—Total length, 9.35 mm.

Integument of the carapace black, clothed rather sparsely with short black hairs, those of the frontal margin more conspicuous, curling over the eyes of the first row. Clypeal region reddish brown. Chelicerae iridescent. Sternum, mouth parts and coxae brown, shining, the covering of black hairs inconspicuous. Legs dark brown to black, the first leg enlarged and fringed with black hairs, the patella with a gray fringe; the second leg like the first; the last two pairs less conspicuously fringed, the tibia and metatarsi with distinct light basal annulae which are overlaid with white scales. Dorsal surfaces of legs with a few white scales, the palpi black. Integument of the abdomen black, the dorsum covered basally and on the sides with red hairs, the interval between forming an irregular median black band that goes no farther forward than the middle of the dorsum, at which point are two red spots.

Carapace, 4.20 mm. long, 3.65 mm. at the broadest point behind the third eye row. The cephalic portion flat above, the moderately expanded sides convex, the posterior declivity abrupt and beginning just behind the middle of the carapace. First row of eyes recurved, the medians much larger (24/14), scarcely a fifth of a diameter apart, twice as far from the laterals. Eyes of the second row very small, half as far from the anterior lateral eye as the eye of the last row (15/30). Third eye row eight-elevenths as broad as the carapace at that point, broader than the first row (40/24), the eyes two-thirds as large as the anterior laterals. Quadrangle of eyes about three-sevenths as long as the length of the carapace.

Legs 1423, the first tibia with three pairs of stout, short spines on the distal half of the ventral surface. Labium longer than broad, three-fifths as long as the endites which are armed on the outer side at the distal margin with a small tubercle. Chelicerae with a single tooth on the lower margin of the furrow. Sternum much broader than long, the last coxae subcontiguous, the enlarged first coxae separated by two-thirds the sternal width.

Male palpus clothed with black hairs, the patella twice as long as the tibia, which is armed on the outer side with a stout, distally slightly curved spur. Bulb as in *Phidippus ardens* Peckham, the embolus a very short, heavy process as in that species.

FEMALE.—Total length, 10.50 mm. Carapace, 4.75 mm. long, 4.10 mm. wide.

Cephalothorax clothed as in the male, the integument of the eye area black, the remainder dark reddish-brown. Palpus and clypeus with long white hairs, the chelicerae iridescent green on the distal outer surface. Eyes as in the male. Legs provided with more white scales and hairs than in the male, all weakly fringed beneath. Abdomen with either red or yellow narrow, irregular side bands, the interval between broad, as long as the dorsum and overlaid with small, shining black scales.

Epigynum resembling that of *P. ardens*, the caudal margin deeply notched as in that species, the distal half of the plate a shallowly excavated, rounded depression.

TYPE LOCALITY.—Male holotype, female allotype, and paratypes of both sexes from Slough Creek, Yellowstone National Park, Wyoming (W. E. Gertsch). Numerous paratypes of both sexes from the following localities in Alberta: Seba, June and July; Devil's Lake, July; MacMurray, September; Waterton Lake, September; Medicine Hat, August; Fawcett, May. Also from Cypress Hills, Saskatchewan, July.

This species falls into Peckhams' group of red spiders, though the females may be red or yellow in life. The male palpus is closely related to those of *Phidippus ardens* Peckham, *P. apacheanus* Chamberlin and Gertsch, and *P. purpuratus* Koch. In the first two forms the abdomen is all red above, in no case banded as in *P. altanus*, and in addition *P. apacheanus* has the carapace covered with bright red hairs. *Phidippus purpuratus*, belonging in the group in which the abdomen is gray and spotted, need not be considered. None of these other species have been taken as far north as the region where this new form is a common and characteristic element of the salticid fauna.

#### ***Phidippus kaibabensis*, new species**

Figure 19

MALE.—Total length, 8.00 mm.

Integument of the carapace dark reddish-brown, nearly black at the caudal margin and in the eye quadrangle, the frontal margin with long black hairs. Clypeal region light reddish-brown in color, clothed with gray hairs. Chelicerae slightly iridescent, the mouth parts, sternum, and coxae brown, sparsely clothed with black hairs. Legs reddish brown, the femora infuscated, the tibiae, metatarsi and patellae with distal black annulae. Femur of the first leg with a basal bunch of white hairs beneath, otherwise fringed in black, the patella with white hairs beneath, the tibia with a long black fringe. The other legs with black and white hairs and some white scales. Integument of the abdomen black, with a median red maculation and two pairs of transverse markings behind, the whole of the dorsum apparently covered in living specimens with white scales. Venter gray.

Carapace, 3.60 mm. long, 3.15 mm. at the broadest point, just behind the third eye row. Cephalic portion flat above, moderately expanded on the sides. First row of eyes recurved, the medians separated by one-fifth of their diameter, twice as far from the laterals, which are much smaller (25/15). Eyes of the second row very small, much nearer the anterior lateral eye than the posterior (17/28). Third eye row four-



fifths as wide as the width of the carapace at that point, broader than the first eye row (77/66), the quadrangle formed by these eyes much broader than long (77/46). Legs 1423, the first tibia with three pairs of stout spines beneath, placed in the distal half of the joint.

Male palpus clothed with black hairs, the patella slightly longer than the tibia, which is armed on the outer side with a short, stout, hooked spur. Bulb as in *Phidippus arizonensis* Peckham, the embolus a slender spur strongly bent at the distal end.

TYPE LOCALITY.—Male holotype from the Kaibab forest, near the north rim of the Grand Canyon, Arizona, July 8, 1931 (Gertsch).

This species differs from *P. arizonensis* in the following characters. It completely lacks dorsal bands of white hairs on the carapace and has a variegated fringe of black and white hairs beneath the first leg, rather than the bright yellow hairs of the other species. The carapace shows no trace of the pronounced tubercles present in most examples of *arizonensis* and lacks curled tufts of strong black hairs in the eye area.

#### ***Phidippus peritus*, new species**

Figure 18

MALE.—Total length, 14.25 mm.

Integument of the carapace dark red, the eye area darker, clothed evenly with short black hairs, the frontal margin with longer hairs. Chelicerae iridescent green. Under side of the cephalothorax reddish brown, the legs darker and fringed as follows: first leg with a black fringe above and below on the femur, the patella with a ventral white fringe, the remaining joints with scattered gray and black hairs above, the ventral surfaces with a heavy fringe of black hairs; second legs much as the first; last two legs with numerous dark hairs on all surfaces. Dorsum of the abdomen covered with red hairs, the caudal end with two narrow black stripes, the sides and venter darker.

Carapace, 4.62 mm. long, 4.25 mm. at the broadest point. The cephalic portion of the very broad carapace flat above, considerably expanded on the sides, convex, the posterior declivity beginning two-thirds of the length back and abruptly dropping to the caudal margin. First row of eyes recurved, the very large medians scarcely half a diameter from the clypeal margin, less than a fifth of a diameter apart, twice as far from the laterals, the diameters of which are half as great as the medians. Eyes of the second row very small, two-fifths as far from the anterior lateral as the eye of the last row. Third row of eyes broader than the first (11/8), occupying three-fourths of the width of the carapace at that point, the eyes on black tubercles. Ocular area nearly half of the length of the carapace.

Leg formula 1423, the first leg greatly enlarged and much larger than the others, the tibia and patella taken together longer than the carapace, the tibia with three pairs of short, stout spines beneath the distal half. Labium longer than broad, three-fifths as long as the endites, which are armed on the outer side with a well-developed hook. Chelicerae armed with a single tooth on the lower margin. Sternum much longer than broad, the enlarged first coxa separated by its width, the last coxae subcontiguous.

Male palpus covered with long black hairs, the femur strongly bent, as long as the tarsus, the patella a little longer than broad, nearly twice as long as the tibia. Tibial apophysis nearly parallel with the joint for most of its length, gently curved

down at the end. Bulb as in *P. ardens* Peckham, the embolic portion considerably longer, the bulb proper a rounded lobe, behind which is a short spur that remains hidden when viewed from the ventral aspect.

TYPE LOCALITY.—Male holotype from Live Oak County, Texas, June 6, 1919 (Barnum Brown).

This species runs to *Phidippus ardens* in the Peckhams' key to the red spiders. *P. peritus* is a much larger species, has the carapace proportionately much broader and higher, and has the patella and tibia of the first leg longer than the carapace (about equal in *ardens*).

### *Phidippus adumbratus*, new species

#### Figure 14

MALE.—Carapace, 3.65 mm. long, 3.00 mm. wide.

Integument of the carapace brown, clothed with black hairs and white scales. Clypeus and sides of carapace overlaid with white scales, continuous with a narrow frontal band behind the first eye row. Chelicerae dark brown, slightly iridescent, covered with long, silky white hairs. Under side of carapace light brown, the legs banded as follows: femur of the first leg basally white, distally black, heavily fringed above and below with black hairs; patella with a white fringe below, tibia overlaid with white scales above on the basal half, the remainder black, the joint fringed with black hairs below; the metatarsus with a distal black ring. Other legs less conspicuously ornamented than the first but with annulae as in the first leg, more evenly clothed with white scales.

Ocular area about two-fifths as long as the carapace. Eyes of the first row recurved, the medians much larger than the laterals (23/12), separated from each other by one-sixth of their diameter, twice as far from the laterals. Eyes of the second row very small, much nearer the anterior than the posterior eye (12/26). Third row of eyes broader than the first (38/31), nearly as broad as the width of the carapace, which is only slightly expanded on the sides. Labium longer than broad, three-fifths as high as the endites, which have a tubercular hook on the outer distal margin. Chelicerae with a single tooth on the lower margin. Leg formula 1423, the first leg greatly enlarged, armed with the conventional three pairs of distal spines on the ventral surface of the tibia, the tibia and the patella equal to the length of the carapace.

Palpus rather short, yellow, clothed with long white hairs. Femur about as long as the tarsus, almost twice as long as the subequal patella and tibia, the latter joint with a black, ventrally directed spur, slightly hooked at the end when seen from the ventral aspect. Bulb closely resembling that of *P. putnami*, but the embolus a much finer, strongly curved tube.

TYPE LOCALITY.—Male holotype from Los Angeles, California (Grant).

The abdomen is missing from the above described species but the characters of the legs and carapace are so important and distinctive that I do not hesitate to give it a name. While this species is closely related

to the group including *Phidippus coccineus*, *putnami* and *femoratus*, it may be easily separated by the characters of the first leg.

***Phidippus concinnus*, new species**

Figure 17

MALE.—Total length, 6.00 mm.

Integument of the carapace reddish brown, clothed evenly with fine black hairs, the frontal margin with numerous longer curved hairs. Carapace with conspicuous white stripes on each side, made up of white scales, margining the carapace behind but not on the frontal margin. Under side of cephalothorax light brown, the legs darker. Chelicerae reddish brown, not iridescent, covered with long white hairs. Legs with scattered white scales above, the first femur nearly black, fringed beneath with black hairs, the patella lighter and with a white ventral fringe, the tibia distally black and fringed with hairs of that color. The third and fourth legs with black distal annulae on the tibia and metatarsi. Abdomen red above, with a single, broad, irregular median black band, the venter gray.

Carapace, 3.15 mm. long, 2.65 mm. broad.

Pars cephalica flat above, the sides moderately expanded, convex, the posterior declivity beginning two-thirds of the length behind and abruptly dropping to the caudal margin. First row of eyes recurved, the medians much larger (20/10), one-fourth of a diameter from the clypeal margin, separated from each other by one-fifth of a diameter, a little farther from the laterals. Eyes of the second row very small, scarcely twice as far from the posterior eyes as their distance from the anterior laterals. Third eye row wider than the first (32/27), about three-fourths as wide as the breadth of the carapace at that point. Quadrangle of eyes a little more than two-fifths as long as the length of the carapace.

Leg formula 1423. The first leg greatly enlarged, the tibia and patella scarcely as long as the carapace, the tibia with three pairs of spines on the distal portion of the ventral face. Labium a little longer than broad, half as high as the maxillae, which have a poorly developed hook on the outer side. Chelicerae with a single tooth on the lower margin. Posterior coxae subcontiguous.

Male palpus light brown, the distal portion of the femur and the patella and tibia overlaid with white scales. Patella about equal in length to the tibia, which is armed with a short, black spur, directed ventrad. The details of the bulb and the embolus are nearly identical with Peckham's figure of *Phidippus tyrelli*.

TYPE LOCALITY.—Male holotype from hot springs near Bear Lake, Idaho, August 12, 1931 (Gertsch).

This species may be easily confused with *Phidippus insignarius* (C. Koch) or *P. tyrelli* Peckham. In the latter species the white band almost completely margins the carapace, which is not true of the other species. The fringes on the legs of *insignarius* are all white, are black in *concinnus*, and are both black and white in *tyrelli*.



11



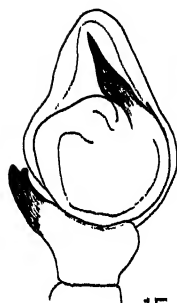
12



13



14



15



16



17



18



19



20



21



22

#### PALPI AND EPIGYNA

Figs. 11-12. *Peckhamia idahoana*, new species.

Fig. 13. *Phidippus altunus*, new species.

Fig. 14. *Phidippus adumbratus*, new species.

Figs. 15-16. *Pellenes shoshonensis*, new species.

Fig. 17. *Phidippus concinnus*, new species.

Fig. 18. *Phidippus peritus*, new species.

Fig. 19. *Phidippus kuibabensis*, new species.

Fig. 20. *Sassacus aemulus*, new species.

Fig. 21. *Pellenes altanus*, new species.

Fig. 22. *Metaphidippus paiutus*, new species.

**Metaphidippus paiutus**, new species

Figure 22

MALE.—Total length, 3.65 mm. Carapace, 1.80 mm. long, 1.25 mm. wide.

Integument of the cephalothorax dark brown to black, closely overlaid with white scales on the sides and in a band along the frontal margin, the area delimited by the eyes slightly iridescent. Sternum, mouth parts and chelicerae brown. Femur of the first leg dark brown, the remaining joints lighter, the posterior legs yellow, all sparsely clothed with white hairs. Abdomen brown, closely overlaid with white scales.

Carapace flat above, the sides gently rounded, the widest point just behind the last eye row. First row of eyes recurved, the large medians almost contiguous, farther from the laterals. Eyes of the second row very small, twice as far from the posterior eye as the anterior lateral. Posterior eye row broader than the anterior (49/40), the eyes slightly smaller than the anterior laterals, the quadrangle formed by the laterals of the two rows three-fourths as long as broad. Chelicera robust, vertical in position, the fang curved distally, fitting into a groove formed by the large tooth of the lower margin and two on the upper, the teeth elevated on a large tubercle.

Legs 1423, the first much longer and heavier than the others, the tibia with 1-2-1 spines beneath in the distal half. Male palpus as figured.

TYPE LOCALITY.—Male holotype from Richfield, Utah, July 4, 1931. Male paratypes from St. George, Utah, July (Davis).

**Metaphidippus nigromaculatus** (Keyserling)

*Icius nigromaculatus* KEYSERLING, 1884, Verh. k.k. zool.-bot. Gesell., Wien, XXXIV, p. 500, Pl. XIII, fig. 9.

*Dendryphantes jeffersoni* EMERTON, 1909, Trans. Connecticut Acad. Arts and Sci., XIV, p. 225, Pl. XI, fig. 3.

On page 363 of the 'Revision of the Attidae of North America,' the Peckhams state, after having reviewed all the types of the family deposited in museums in the United States, that "*Icius nigromaculatus* is a good species, belonging to *Dendryphantes*." In the taxonomic section, however, the species is left in *Icius*, either inadvertently or because of the impossibility of changing the text at that stage in the publication. The specimen they describe should be referred to some other species. Keyserling's type was from Utah, where the species is common.

**Metaphidippus helenae** (Banks)

*Dendryphantes helenae* BANKS, 1921, Proc. California Acad. Sci., (4) XI, pp. 101-102, fig. 5.

*Dendryphantes sausalitanus* CHAMBERLIN, 1924, idem, XIV, pp. 137-138, fig. 57.

I have examples of this species from Richfield and Fish Lake, Sevier County, Utah. No doubt it will be found generally distributed from the Rocky Mountains to the Pacific coast.

***Metaphidippus vitis* (Cockerell)**

*Dendryphantes vitis* COCKERELL, 1894, Entomologist, XXVII, p. 207.

*Icius vitis* PECKHAM, 1909, Trans. Wisconsin Acad. Sci., XVI, p. 501, Pl. XL, fig. 11, Pl. XLJ, fig. 7.

*Dendryphantes apachecus* CHAMBERLIN, 1924, Proc. California Acad. Sci., (4) XIV, pp. 136-137, Figs. 55 and 56.

The generic position of this species and others that were placed in *Icius* by Peckham is somewhat dubious. For the present I am referring it to *Metaphidippus* where other closely related species have been placed. *M. vitis* is a common species in the southwestern States.

***Paraphidippus marginatus* (Walckenaer)**

*Attus marginatus* WALCKENAER, 1837, 'Histoire naturelle des Insectes Aptères,' I, p. 466.

*Phidippus molinor* CHAMBERLIN, 1925, Proc. California Acad. Sci., (4) XIV, p. 133, Fig. 49.

***Metacyrba floridana*, new species**

FEMALE.—Total length, 5.85 mm. Carapace, 2.20 mm. long, 1.33 mm. wide. Abdomen, 3.60 mm. long, 1.42 mm. wide.

Cephalothorax provided with a few weak spines on the clypeus and between the eyes of the first row. Carapace black, thickly overlaid with minute, shining black scales, the margins of the pars thoracica with a single row of white scales. Sternum, labium, endites, and first coxae brown, the other coxae and the last three pairs of legs yellowish brown. Femur, metatarsus, and tarsus of the first leg yellowish brown, the patella and tibia darker. Abdomen almost black, without lighter markings on the integument but with remnants of a line of white scales on each side. Venter dusky.

Cephalothorax flat for most of its length, convex behind and on the sides. Eyes of the first row recurved, the upper margins in a straight line, subcontiguous, the medians much larger (17/7). Eyes of the second row very small, slightly nearer the anterior laterals than the posterior eyes (10/12). Posterior eye row nearly as wide as the greatest cephalothoracic width (59/84), broader than the first row (59/55), the eyes smaller (5/7) than the anterior laterals. Quadrangle of posterior eyes and the anterior laterals much broader than long (59/33). Clypeus very narrow, the anterior median eyes practically marginal.

Sternum twice as broad as long, the first coxae and the last pair contiguous. Chelicerae with a single small tooth on the lower margin. Leg formula 1423, the first leg greatly enlarged, the femur incrassate dorsoventrally, the sides almost flat. Tibia I with two pairs of very small spines near the distal end beneath, the first metatarsus with two somewhat longer pairs. Abdomen more than twice as long as broad, gently rounded on the sides. Epigynum almost identical with that of *Metacyrba taeniola* (Hentz).

TYPE LOCALITY.—Female holotype from Fort Meyers, Florida, March 30, 1912.

Only two other species of *Metacyrba* are known from the Americas. *M. floridana* is much more elongate than the common species from the

United States, *M. taeniola*, both the cephalothorax and the abdomen being much longer than in that species. The quadrangle of the anterior laterals and the posterior eyes is 59:33 in *floridana*, 60:38 in *taeniola*.

**Pellenes shoshonensis**, new species

Figures 15 and 16

MALE.—Total length, 3.50 mm. Carapace, 1.90 mm. long, 1.30 mm. wide. Abdomen, 1.70 mm. long, 1.00 mm. wide.

Integument of the carapace brown to black, clothed with white scales and a few spines, the clypeus and the frontal margin with short, reddish scales. Carapace with a dark band from the posterior eyes to the caudal margin, the sides with a marginal black stripe. Legs mottled with black, clothed with white scales. Abdomen with a narrow, median, longitudinal white stripe running the full length above, the sides and venter lighter, all thickly clothed with white scales.

Area of the eyes occupying two-fifths of the length of the carapace. Eyes of the first row recurved, equidistantly spaced, the medians about half a diameter from the clypeal margin, twice as large as the laterals. Eyes of the second row very small, midway between the two rows. Third row of eyes very slightly broader than the first, the eyes smaller than the anterior laterals. Ocular quadrangle much broader than long (40/25).

Palpus thickly overlaid above with white scales. Patella a little longer than the tibia, the latter with a very heavy apophysis that appears notched from the ventral aspect but, when viewed from the side, is nearly as broad as long, basally narrowed, slightly hooked distally. The bulb is oval, the inner side with a very heavy, straight black tube that ends acutely.

TYPE LOCALITY.—Male holotype from Adelaide, Idaho, May 15, 1931 (D. E. Fox).

The character of the embolus will distinguish this species from all others but *Pellenes peninsularis* Emerton, *P. limatus* Peckham, and *P. longimanus* Emerton. In all these forms the tibial apophysis is heavy at the base and pointed at the distal end, which is not true for *P. shoshonensis*, new species.

**Pellenes captiosus**, new species

MALE.—Total length, 4.75 mm. Carapace, 2.45 mm. long, 1.82 mm. wide. Abdomen, 2.25 mm. long, 1.62 mm. wide.

Integument of the carapace black, with a narrow frontal band of white scales and scattered white scales on the posterior declivity. Area of the eyes overlaid with inconspicuous, shining black scales. Frontal margin and clypeus provided with long brown hairs. Chelicerae brown, mouth parts dusky, the sternum and coxae yellow, all rather thickly clothed with long white hairs. First leg yellow, modified as follows: femur, patella, and tibia with heavy, double, subventral fringes of yellowish hairs, the tibia armed with two spatulate spines on the inner side; dorsum and sides of the joints thickly clothed with white scales. Second legs with a short ventral fringe of yellowish white hairs. Third leg strikingly modified as follows: femur mostly brown,

distally strongly thickened; patella brown, medially thickened, the dorsum with a fringe of black hairs, the distal end produced into a light-colored lobe that overlaps the tibia; distal joints yellow. Last leg yellow, the distal end of the femur and the patella brown above, all the joints thickly overlaid with white scales and hairs. Abdomen black, basally with a white band, the sides with a medial oblique white dash, the caudal end with two white dots and an elongate white maculation. Venter light.

Eyes of the first row recurved, their upper margins in a straight line, the larger medians one-fifth of their diameter apart, twice as far from the laterals. Eyes of the second row very small, midway between the anterior laterals and the eyes of the third row. Posterior eye row slightly broader than the first (59/55), the quadrangle formed by these eyes nearly twice as broad as long. Clypeus half as high as the diameter of an anterior median eye.

Leg formula 1423, the first tibia with 2-2-2 spines beneath, two spatulate, the metatarsi with two pairs.

Palpus covered with white and yellow hairs. Palpal organ identical in structure with that of *Pellenes borealis* Banks, which this species closely resembles.

TYPE LOCALITY.—Male holotype and paratype from Barnum, Minnesota, June, 1932 (J. E. Moore).

The only important difference between this species and *P. borealis* Banks is the remarkable modification of the first and third legs.

### *Pellenes altanus*, new species

#### Figure 21

MALE.—Total length, 3.80 mm. Carapace, 1.82 mm. long, 1.40 mm. wide. Abdomen, 1.50 mm. long, 1.15 mm. wide.

Integument of the cephalothorax black, the eye quadrangle overlaid with white scales that are thicker on the frontal margin, forming a narrow band, the sides and posterior declivity with scattered white scales. Clypeus dark brown, the mouth parts, sternum, and coxae yellowish brown. Legs yellowish brown, the first femur black on the sides, the other femora with black maculations, the patellae, tibiae, and metatarsi of all the legs with a subventral narrow black stripe on the prolateral face of the joints. Legs sparsely clothed with black hairs. Abdomen black above, somewhat spotted and flecked with white, the venter light. Tarsus of the palpus clothed with short orange scales.

Eyes of the first row recurved, the large medians one-eighth of their diameter apart, twice as far from the laterals. Small eyes of the second row midway between the anterior laterals and the posterior eyes. Third row of eyes broader than the first (44/40), the quadrangle formed by the laterals broader than long (44/36). Eye area occupying three-sevenths of the length of the carapace.

Leg formula 3412, the first pair of legs not much stouter than the others, lacking fringes or peculiar ornamentation, the tibiae with 1-1-2 spines beneath. Third leg unmodified, with two unpaired spines beneath and two prominent prolateral spines that project dorsad. Palpus as figured.

TYPE LOCALITY.—Male holotype from Medicine Hat, Alberta, August 1, to 16, 1930. Male paratype from Saskatoon, Saskatchewan.



***Sassacus aemulus*, new species**

Figure 20

MALE.—Total length, 3.00 mm. Carapace, 1.50 mm. long, 1.17 mm. wide. Abdomen, 1.50 mm. long, 1.12 mm. wide.

Frontal margin of the carapace with a few short spines and white scales. Ocular quadrangle black, closely overlaid with small iridescent purple scales. Sides of carapace and the posterior declivity reddish brown, the margin with a narrow band of white scales. Sternum and labium black, the coxae and endites light brown. First leg strikingly modified as follows: femur, patella, and tibia greatly thickened dorso-ventrally, flattened on the sides; femur black, patella and tibia reddish brown, both with a heavy ventral fringe of coarse black hairs, the tibia with an additional shorter dorsal fringe; metatarsus yellow, tarsus brown. Posterior three pairs of legs considerably shorter and weaker, the basal joints light brown, the metatarsi and tarsi yellow. Abdomen black, lacking basal bands or lighter color markings, covered with iridescent white scales and inconspicuous dark hairs.

Eye area occupying seven-twelfths of the length of the flat dorsum of the carapace. First row of eyes recurved, the medians much larger (12/7) than the laterals, about one-third their diameter from the clypeal margin. Eyes of the second row very small, slightly nearer the anterior lateral than the posterior eye (10/12). Posterior eye row marginal, broader than the first row (38/45), the eyes about equal to the anterior laterals, the quadrangle of the anterior and posterior eyes broader than long. Sides of the carapace nearly vertical, the posterior declivity abrupt, beginning well behind the third eye row.

Leg formula 1423, the enlarged first tibia with a single submedian, retrolateral spine and a pair near the distal end, the metatarsus with two pairs beneath, the last pair distal. Chelicerae with a single short tooth on the lower margin. Labium broader than long, about half as high as the slightly convergent endites. Sternum longer than broad, the last coxae contiguous, the first separated by their width.

Male Palpus.—Femur as long as the tarsus, longer than the equal tibia and patella. Tibia with a retrolateral black spur, acutely ended, nearly as long as the joint. Bulb oval, the embolus a slender curved tube that is free at the middle of the bulb on the prolateral side.

TYPE LOCALITY.—Male holotype from Itasca Park, Minnesota, May 29–30, 1932 (Gertsch).

This species is closely related to *Sassacus barbipes* Peckham and *S. dentata* F. Cambridge, both of which were placed in *Ashtabula* by Cambridge. The embolus is terminal in both of these forms, which is not true for *aemulus*. *Sassacus barbipes* has a basal light band on the abdomen and the tibia lacks the dorsal fringe of coarse black hairs. The important differences between these forms and the typical species of *Sassacus* (*papenhoei* Peckham and *smaragdinus* Barrows) seem to warrant their separation into another genus.

## AGELENIDAE

The first species described below was sent to me by Dr. W. M. Barrows, who diagnosed the species as new and requested that I describe it. He has generously given the types to The American Museum of Natural History. The second species, collected by Mr. Stanley Mulaik at Edinburg, Texas, is closely related and shares the unusual palpal characters of *Agelena barrowsi*.

*Agelena barrowsi*, new species

Figures 8 and 9

MALE.—Total length, 4.35 mm., exclusive of the spinnerets. Carapace, 2.10 mm. long, 1.50 mm. wide. Abdomen, 2.30 mm. long, 1.40 mm. wide.

Integument of the cephalothorax yellow, clothed with a few short, inconspicuous black hairs. Eyes in a black field. Carapace with a submarginal light band and a narrow black marginal seam, medially with two poorly defined dusky bands, the interval between them light. Labium dusky, the endites pale, the sternum black but with a median pale stripe. Legs irregularly maculate with black, the distal end of the metatarsi with a narrow black ring. Dorsum of the abdomen with a longitudinal light band, tinged with red, broken caudally by transverse black bands. Sides of the abdomen black, the venter paler and furnished with two narrow black longitudinal bands.

Eyes of the first row strongly procurved, the medians slightly larger, subcontiguous. Second row of eyes strongly procurved, the medians slightly smaller, placed about one-half of their diameter apart. Median ocular quadrangle slightly longer than broad (7/8), about as wide in front as behind, the posterior median eyes smaller. Lateral eyes of both rows subequal and subcontiguous. Clypeus one-third as high as the diameter of an anterior lateral eye. Chelicerae with three teeth on the lower margin.

Spines under the first two tibiae, 2-2-0, the metatarsi, 2-2-2. Tibia and patella I equal in length to tibia and patella IV, longer than the carapace (20/17). Distal joint of the posterior spinneret slightly longer than the basal.

Male Palpus.—Patella slightly longer than broad, longer than the tibia, which is armed on the outer side with a stout spur as in *A. naevia*. Bulb expanded, the inner side provided with a slightly curved, robust, brown apophysis that ends in a sharp point. Conductor a short, sclerotized spur that, in lateral view, is deeply notched at the free end. Embolic portion a brown tube, originating near the inner basal margin, strongly and tightly wound; the embolus proper is free at that point as a strongly ridged, flattened tube, making nearly two and a half turns, becoming progressively narrower, and ending as fine acuminate tube. The spirals are at right angles to the long axis of the tarsus, not on the same plane as in *Agelena naevia*, *potteri*, *utahana*, etc., and the acuminate tip exceeds the distal end of that joint.

FEMALE.—Total length, 6.00 mm., exclusive of the spinnerets. Carapace, 2.80 mm. long, 1.90 mm. wide. Abdomen, 3.90 mm. long, 2.10 mm. wide.

Color darker than in the male, the legs with larger black maculations, the distal annular of the metatarsi well marked. Spinnerets as in the male, the distal joint of the posterior pair slightly longer than the basal (0.52 mm./0.42 mm.). Vulva half as

long as broad, transversely elliptical, strongly rounded in front and the margin at that point provided with two small, rounded, colorless lobes. Atrial cavity, as seen from the caudal view, divided by a broad median septum, which is not apparent from the ventral aspect.

**TYPE LOCALITY.**—Male holotype from Fort Meyers, Florida, February, 1930 (W. M. Barrows). Female allotype and two female paratypes from Gainesville, Florida, February 12, 1925 (W. M. Barrows).

The female of *A. barrowsi* is of the conventional type and might easily be confused with such species as *Agelena utahana* Chamberlin and Ivie or *A. potteri* Blackwall. The male, however, is radically different in palpal characters from all other American species, except *A. texana*.

### *Agelena texana*, new species

**MALE.**—Total length, 8.25 mm., exclusive of the spinnerets. Carapace, 4.25 mm. long, 3.10 mm. wide. Abdomen, 4.15 mm. long, 2.00 mm. wide.

Integument in general a little darker than in *A. barrowsi* but color markings exactly as in that species. Eyes of the first row strongly procurved, equal in size, subcontiguous. Posterior row of eyes strongly procurved, the medians smaller, the eyes about a diameter apart, the laterals smaller than the anterior laterals. Median ocular quadrangle longer than broad (25/20), slightly narrower behind, the anterior medians much larger. Clypeus a little higher than the diameter of an anterior lateral eye.

Sternum nearly as broad as long, the anterior coxae separated by their length, the posterior subcontiguous. Labium slightly broader than long, half as high as the parallel endites. Chelicerae armed with four stout, subequal teeth on the lower margin, the upper with three. Leg formula 4123. First tibia with 2-2-0 ventral spines, the distals missing; the second tibia 1-1-0, the prolaterals missing, as well as the distals; the metatarsi of these legs with 2-2-2 spines beneath. Patella and tibia of the fourth leg equal in length to the carapace, those joints of the first leg a little longer. Spinnerets short, the basal joint of the posterior pair two-thirds as long as the distal (0.50 mm./0.80 mm.).

**Male Palpus.**—The genital organ of the male differs only in minor details from that of *A. barrowsi*. The tibial apophysis is a heavy spur, retrolateral in position, that has the same form as in *A. nacvia* and other species. The process on the inner side of the bulb near the base is heavily sclerotized, brown in color, curved and rounded at the end, as viewed from the ventral aspect. The conductor is deeply notched as in *A. barrowsi* and the embolic portion has almost the same form. The embolus proper is a strongly ridged, heavy, somewhat flattened tube, the inner margins white, which is tightly coiled for two turns, the free acuminate tip going to the end of the cymbium.

**TYPE LOCALITY.**—Male holotype from Edinburg, Texas (S. Mulaik).

The greater size of this species, the presence of four teeth on the lower cheliceral margin and the slight differences in the embolus will separate it from *A. barrowsi*.

*Agelena idahoana*, new species

## Figure 5

FEMALE.—Total length, 9.40 mm. Carapace, 4.00 mm. long, 3.20 mm. wide. Abdomen, 5.70 mm. long, 3.00 mm. wide.

Integument of the cephalothorax and legs dark brown, without contrasting markings. Abdomen dark brown above, evenly and densely maculate with small yellow spots, the venter with light stripes on the sides.

Eyes of the first row procurved, equidistantly spaced about one-third of a diameter apart. Second row of eyes procurved, equal in size and spaced four-fifths of a diameter apart. Median ocular quadrangle slightly longer than broad (22/19), as broad in front as behind, the anterior median eyes slightly larger. Clypeus equal in height to one and one-half times the diameter of an anterior lateral eye. Chelicerae with two subequal teeth on the lower margin, the upper with three unequal denticles.

Legs rather slender, all the tibiae with 2-2-2 spines beneath, the tibia and patella of the fourth pair longer than the carapace (5.00 mm./4.00 mm.), those joints of the first leg equal in length to the carapace. Spinnerets rather short, the basal joints of the anterior and posterior pair subequal, the distal joint of the posterior pair about equal to the basal joint.

Epigynum as figured.

TYPE LOCALITY.—Female holotype from Montpelier, Idaho, August, 1931 (Gertsch).

The unmarked carapace and unbanded legs, the short distal joint of the hind spinnerets, and the quite different epigynum will separate this species from *Agelena californica* Banks. In Bank's species the eyes of both rows are about equal in size and the median ocular quadrangle is slightly narrowed in front.

*Agelena aperta*, new species

## Figure 10

MALE.—Total length, 11.00 mm. Carapace, 5.30 mm. long, 3.80 mm. wide. Abdomen, 6.30 mm. long, 3.30 mm. wide.

Integument of the cephalothorax bright yellow, clothed with short, inconspicuous, black and white hairs. Carapace with two black stripes above and a dark marginal seam. Mouth parts, sternum, and legs bright yellow, unmarked. Abdomen gray above, with two white stripes that are broken into spots in the caudal half, the venter gray.

Eyes of the first row procurved, equal in size, separated by a radius. Second row of eyes procurved, slightly smaller than the anterior row, separated by a diameter. Median ocular quadrangle slightly longer than broad (21/19), though apparently much more so, as wide behind as in front, the posteriors smaller. Clypeus equal in height to twice the diameter of an anterior median eye. Chelicerae with three subequal teeth on the lower margin (four on one side in the male holotype), the upper margin with three unequal teeth.

Spines under the tibiae 2-2-2, the distals often unpaired, under the first metatarsi 2-2-2. Tibia and patella I about equal in length to tibia and patella IV, longer

than the carapace (21/16). The same comparisons in *Agelena naevia* give a ratio of about 21:12. Distal joint of the posterior spinneret more than twice as long as the basal (24/10).

**Male Palpus.**—Structure as in *Agelena naevia* Walckenaer, the chief difference being in the embolus, which is proportionately heavier, broadly encircles the periphery of the tarsus for one and a quarter turns, is little diminished in size throughout its length, and has the heavy tip folded and twisted, not acuminate as in *naevia*.

**FEMALE.**—Variation in size in this sex is considerable. The smallest female measures 10.00 mm., the largest 19.00 mm., exclusive of the spinnerets. In structure and color the females agree well with the males but are usually a little darker and have the white spots on the abdomen better defined. The epigynum closely resembles that of *Agelena naevia* but in all examples lacks the prominent lobe that projects caudally into the atrial cavity in *naevia*. That margin in *aperta* may be either straight or distinctly notched. The distal joint of the hind spinnerets is over twice as long as the basal.

**TYPE LOCALITY.**—Male holotype, female allotype, and paratypes of both sexes from Valmont Buttes, east of Boulder, Colorado, July 27, 1908 (F. E. Lutz). Paratypes from Boulder, Colorado (Cockerell); Austin, Texas, September, 1909 (Petrunkévitch); Salt Lake City, Utah, July, September, 1931 (Gertsch); Zion National Park, Utah, July 4, 1931 (Gertsch); Los Angeles, California, November, December (Grant).

Representatives of this species have been consistently referred to *Agelena naevia* Walckenaer, which is a complex found to include several well-marked species. The distribution of this species or subspecies is essentially western. The differences in the genitalia are constant throughout a large series of specimens.





# AMERICAN MUSEUM NOVITATES

Number 727

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

May 29, 1934

59.57,72 S (67.5)

## SARCOPHAGINAE OF THE AMERICAN MUSEUM CONGO EXPEDITION. (DIPTERA)<sup>1</sup>

By C. H. CURRAN

FIGURES 1 TO 41

The Diptera of the American Museum Congo Expedition, with the exception of the Tabanidae and Sarcophaginae, have been recorded in the Bulletin of The American Museum of Natural History.<sup>2</sup> With the publication of the present contribution, records will have been printed of the entire collection of flies made by the members of the expedition. The report on the Tabanidae by Dr. Joseph C. Bequaert appeared in June, 1932.<sup>3</sup>

In addition to the material collected by Messrs. Lang and Chapin, I have included in this report additional material secured by Dr. J. Bequaert and others in equatorial Africa as well as a number of forms from the southern part of the continent, received from Messrs. H. K. Munro and Alexander Cuthbertson. In the case of each species I have prepared drawings illustrating the male genitalia as seen from the side, and in some instances other views are given.

Of the seventy names available for African species of *Sarcophaga* only twenty recorded from the Ethiopian region can be identified, since the genitalia have been illustrated for only this number. A number of the species recorded from the Palaearctic region of Africa are, of course, well known, but the identifications of some of these must be verified. Even when a described species has some apparently conspicuous character that would seem to mark it as distinct from all others, it is not safe to identify it unless the genitalia have been figured, since it is likely that several species will be found to possess the same character. Many of the species before me cannot be separated with any degree of certainty until the male genitalia have been examined, and some are impossible to distinguish by other characters. For this reason I have described as new all species differing from those in which genitalic figures have been published, and it is to be hoped that the types of described species may be examined and the synonymy, if any, determined.

<sup>1</sup>Scientific Results of the American Museum Congo Expedition, Entomology, No. 25.

<sup>2</sup>Volume LVII, Arts. 2 and 4, and volume LVIII, Art. 4.

<sup>3</sup>Amer. Mus. Novit., No. 539, pp. 1-19.



There is a great divergence of opinion regarding the generic limits in the group, and a thorough study of the world fauna will be necessary before any degree of stability can be reached. The presence or absence of propleural hairs does not appear to be of importance in the genus *Sarcophaga* Meigen, but in other cases the character furnishes a simple means of separating the genera. The name *Boeticheria* is available for the species of *Sarcophaga* having the propleura haired, but in some American species the character is of no value as the females may entirely lack the hair. The genus *Helicobia* Coquillett may be recognized because of the bristled first vein. This is not always a generic character, but in this case it separates a fairly large group of species from an unwieldy genus and its use undoubtedly simplifies the identification of the species. Some authors have used *Bercaea* Desvoidy for this genus, but I cannot follow this procedure, since Desvoidy named *haemorrhoidalis* as type of the genus and this species is a true *Sarcophaga*. It is possible that *haemorrhoidalis* Desvoidy is not the same as *haemorrhoidalis* Fallén, but this is not apparent from the description. The name *Bercaea* is better ignored, even though the character of the bristled first vein was used by Desvoidy for the genus, because of the confusion concerning the genotype.

In the key to the males I have used characters other than those found on the genitalia, wherever possible, but these may not always hold, and a comparison of the figures and genitalia of specimens must form the final corroboration. The number of African species belonging to this subfamily no doubt will be found to greatly exceed one hundred, so it is to be expected that several species will trace to the same place in the key. It must be remembered that parts of the genitalia are movable and that there often may be apparent differences in the same species. In small specimens the amount of long hairs on the legs is usually much less than in large specimens of the same species. The measurements of the front are made at the narrowest point and the width of the eye is taken at the widest point, the eye being examined so that its greatest surface is observed. Measurements made in this way are easier to correlate than comparison of the front with the width of the whole head.

Types of all the new species will be found in The American Museum of Natural History.

#### KEY TO MALES OF *Sarcophaga* AND ALLIED GENERA

- |                                      |     |
|--------------------------------------|-----|
| 1.—First vein of the wings bare..... | 2.  |
| First vein bristled.....             | 36. |
| 2.—Propleura bare in the middle..... | 3.  |
| Propleura haired.....                | 26. |

- 3.—Arista plumose.....4.  
Arista short pubescent; abdomen densely cinereous pollinose, with black spots.  
*Wohlfahrtia euvitta* Villeneuve.
- 4.—Wings conspicuously yellowish basally.....5.  
Wings not at all yellowish basally.....6.
- 5.—Middle tibiae long villous.....*Agria* ? *munroi* Curran.  
Middle tibiae without long hairs.....*Agria* ? *condona*, n. sp.
- 6.—Posterior tibiae villous or with very long hairs on one or other of the ventral surfaces.....9.  
Hairs of the posterior tibiae not or scarcely longer than the tibial thickness...7.
- 7.—Second genital segment mostly black in ground color, cinereous pollinose...8.  
Second genital segment shining reddish.....*S. batissa*, n. sp.
- 8.—Genitalia as in figure 35.....*S. fasciventris*, n. sp.  
Genitalia as in figure 38.....*S. binodosa*, n. sp.
- 9.—Postsutural dorsocentrals variable; if three pairs present, the anterior pair is situated almost its own length behind the suture.....10.  
Three pairs of strong postsutural dorsocentrals, the anterior pair situated rather close to the suture.....*S. gnu*, n. sp.
- 10.—Second genital segment wholly or almost all reddish; if blackened above, the hind tibiae villous.....11.  
Second genital segment shining black; hind tibiae with long but not abundant hairs.....*S. maritima* Engel.
- 11.—Second abdominal segment without strong median marginals.....16.  
Second abdominal segment with a pair of long, usually erect, median marginals.....12.
- 12.—Three strong sternopleurals in an almost straight line.....13.  
Sternopleurals 1-1; if three are present, one is weak and placed below the strong anterior.....*S. vicaria*, n. sp.
- 13.—Presutural acrosticals wholly undifferentiated; prescutellars rarely more than half as long as the scutellum.....14.  
Presutural acrosticals conspicuous, but not much more than twice as long as the stout hairs; prescutellars as long as the scutellum.....*S. villa*, n. sp.
- 14.—Apical scutellars present.....15.  
Apical scutellars wholly absent.....*S. chapini*, n. sp.
- 15.—Lateral teeth on penis very strong, the lower serrate (Figs. 27, 28).  
*S. liberia*, n. sp.  
Teeth much weaker (Figs. 29, 30).....*S. samia*, n. sp.
- 16.—Palpi black or brown on apical half or more, rarely reddish brown.....17.  
Palpi wholly dull reddish-yellow.....*S. dura*, n. sp.
- 17.—Posterior femora with several strong, anteroventral bristles on apical half or more.....19.  
Posterior femora with hairlike bristles on anteroventral surface, only the apical bristle strong.....18.
- 18.—Prescutellar acrosticals long and strong.....*S. langi*, n. sp.  
Prescutellars entirely absent.....*S. falciforceps* Villeneuve.
- 19.—First genital segment with two or more bristles or bristly hairs apically much stouter than the surrounding hairs.....20.  
First genital segment almost evenly haired, without bristly hairs.....22.

- 20.—Posterior forceps with a deep notch before the middle as seen in profile (Fig. 32).  
*S. haemorrhoidalis* Fallén.
- Posterior forceps differently shaped.....21.
- 21.—Posterior forceps strongly and angularly produced near the middle (Fig. 6).  
*S. arno*, n. sp.
- Posterior forceps not so produced (Fig. 9).....*S. burungae*, n. sp.
- 22.—Prescutellar acrosticals absent or very weak; genitalia as in figures 14, 15.  
*S. beckeri* Villeneuve.
- Prescutellars well developed; genitalia different.....23.
- 23.—The long hair beneath the middle femora ends abruptly in a longer, denser tuft just beyond the middle; genitalia as in figure 10.....*S. garbo*, n. sp.
- The long hair is not so strongly tufted or not at all so.....24.
- 24.—Fourth abdominal segment broadly reddish apically.....25.
- Fourth abdominal segment wholly black; genitalia as in figure 19...*S. inzi*, n. sp..
- 25.—Palpi large and usually swollen apically (Fig. 16).....*S. mulaba*, n. sp.
- Palpi slender, as usual (Fig. 40).....*S. musitali*, n. sp.
- 26.—Anterior cross-vein surrounded by a large blackish spot.....34.
- Anterior cross-vein at most weakly clouded.....27.
- 27.—Posterior femora with the bristles on the basal half of the anteroventral edge as strong as those on the apical half, rarely only a single strong bristle near the base.....28.
- Posterior femora with at most a weak bristle on the basal half of the anteroventral surface and only two or three strong ones on the apical half.  
*S. afra*, n. sp.
- 28.—Second abdominal segment with a pair of strong, erect, medium marginals; fifth sternite not furcate.....29.
- Second abdominal segment without median marginals.....30.
- 29.—Penis with a pair of recurved apical processes (Fig. 18).....*S. alina*, n. sp.
- Penis with a single, broad, recurved apical process (Fig. 26).....*S. momba*, n. sp.
- 30.—At least two stout bristles on the basal half of the anteroventral surface of the posterior femora.....31.
- A single bristle on the basal half of the anteroventral surface of the posterior femora.....*S. furcadorsalis* Rohdendorf.
- 31.—Fifth sternite swollen and produced downward on basal half in the middle...32.
- Fifth sternite much more deeply divided and not swollen on the basal half...33.
- 32.—Genitalia as in figure 20.....*S. kisangani*, n. sp.
- Genitalia as in figure 41.....*S. bulamatadi*, n. sp.
- 33.—Genitalia as in figure 13.....*S. surda*, n. sp.
- Genitalia as in figure 12.....*S. inducta*, n. sp.
- 34.—Genitalia shining black.....*Poecilometopa notatipennis* Austen.
- Second genital segment reddish.....35.
- 35.—Densely yellowish-gray pollinose species (Fig. 7).  
*Poecilometopa spilogaster* Wiedemann.
- Blue-gray species, much more shining (Fig. 33)..*Poecilometopa congensis*, n. sp.
- 36.—Middle of propleura haired.....38.
- Middle of propleura bare.....*Helicobia alerta*, n. sp.
- 37.—Posterior tibiae villous.....*Helicobia selene*, n. sp.
- Posterior tibiae without long hairs.....*Helicobia munroi*, n. sp.

**Wohlfahrtia Brauer and Bergenstamm**

The only described Ethiopian species occurs in South Africa.

**Wohlfahrtia euvittata Villeneuve**

Figure 1

VILLENEUVE, 1920, Rev. Zool. Afr., VIII, p. 164.

Two specimens of each sex, Jansenville, Cape Province, June 20, 1921.

**AGRIA**

I refer two South African species to this genus with a query, since the status of *Agria* is somewhat in doubt.

**Agria ? munroi Curran**

Figure 11

*Angiometopia munroi* CURRAN, 1927, Ann. Mag. Nat. Hist., XIX, p. 527.

?*Agria brunnipalpis* MACQUART, 1850, 'Dipt. Exot.,' Suppl., IV, p. 235.

?*Sarcophaga elegantipes* VILLENEUVE, 1921, Rev. Zool. Afr., IX, p. 31.

My description of this species was based on five specimens of both sexes from Uitenhage, South Africa, collected by Mr. H. K. Munro on March 5, 1919. No additional material has been examined.

Malloch has expressed the opinion that *munroi* is a synonym of *elegantipes*, and I find that the description of *brunnipalpis* would fit the species very well. Malloch would place the species of *Sarcophaga*, but the shape of the head indicates that it belongs to a different genus.

**Agria ? condona, new species**

Figure 3

Similar to the preceding but the posterior tibiae bear only a few long hairs situated on the anteroventral surface. Length, 13 mm.

**MALE.**—Head silvery-white pollinose; front four-sevenths as wide as either eye, gently widening posteriorly and strongly widening in front; frontal bristles only slightly diverging opposite the antennae; ocellars long and strong; occipital cilia reaching to the cheeks, an irregular row of black hairs behind them; occipital pile pale yellowish; cheeks with black hair; parafacials wide, with rather sparse, moderately long black hairs. Palpi blackish. Antennae black, the third segment only slightly longer than the second; arista with rather short rays on the basal half.

Thorax cinereous pollinose, the mesonotum with three moderately wide black vittae, the median one extending over the scutellum. Acrosticals, 0-1; dorsocentrals, 0-2; sternopleurals, 1-1-1; three pairs of marginal scutellars and a weak sub-discal pair; propleura and prosternum bare.

Legs black, rather thinly cinereous pollinose; middle femora with some long hair posteroventrally; posterior femora with the anteroventral row of bristles complete;

posterior tibiae with some long posteroventral hairs and a few shorter ones anteroventrally.

Wings cinereous hyaline, the veins mostly yellowish; upper lobe of squamae yellow, the lower mostly white. Halteres reddish yellow.

Abdomen blue-black, thickly whitish pollinose, with black spots that change from different views. Fifth sternite U-shaped, the apex filled with dense black spines; first genital segment shining blackish or brown, without bristles, the second orange. Lateral view of genitalia as in figure 3.

FEMALE.—Smaller; 8 to 10.5 mm. Front as wide as either eye; two rows of black bristly hairs behind the upper occipital cilia; scutellum with two pairs of marginal bristles only, the discals and apicals absent; legs without long hairs. First genital segment reddish, longitudinally divided, the sides of the genital opening bordered with black bristles; sixth sternite remarkably long, black and cinereous pollinose on the basal half, the apical half reddish; on either side near the middle with three bristles in a transverse row, the apex very gently rounded.

Types.—Holotype, male, and allotype, female, Uitenhage, Cape Province, March 12, 1919. Paratypes: male, Uitenhage, March 15, 1919 (H. K. Munro), and female, Grootvlei, South Africa, December 9, 1914.

The male is readily distinguished from *munroi* by the long villous tibiae; the female is less easily separated but the sixth sternite is somewhat shorter in *munroi*, more transverse at the apex, and there is an even row of bristles across its middle.

It is not impossible that this species, and not *munroi*, is the same as *brunnipalpis* Macquart, but no species can be identified with certainty until the types have been re-examined and the genitalia studied.

### *Sarcophaga batissa*, new species

#### Figure 31

Tibiae without long hairs; prescutellars long and strong, second genital segment shining deep orange. Length, 10.5 to 12.5 mm.

MALE.—Head silvery-white pollinose; front slightly more than one-third as wide as either eye, widening anteriorly; frontals moderately diverging opposite the antennae. A complete row of black hairs behind the occipital cilia and a secondary row above; occipital pile yellowish white; cheeks with black hair; parafacials with a row of short, fine bristly hairs below and a few scattered hairs on the upper half. Palpi dark brown. Antennae brownish, the third segment twice as long as the second.

Thorax cinereous pollinose, the black vittae very conspicuous, the middle one extending almost to the apex of the scutellum. Acrosticals, 0-1; dorsocentrals, 2-3; sternopleurals, 1-1-1; apical scutellars about as strong as the discals; propleura bare.

Legs black, with cinereous pollen, the tibiae reddish brown. Posterior femora with two or three anteroventral bristles on the apical half; femora and tibiae without long hairs.

Wings cinereous hyaline; third vein bristled about halfway to small cross-vein. Squamae white, the disc sometimes tinged with brown. Halteres reddish, the knob largely brownish.

Abdomen tessellate with cinereous pollen, the second segment without median marginals although there may sometimes be a very weak appressed pair. Fifth sternite divided on more than the apical half, the arms diverging V-like. Lateral view of male genitalia as in figure 31.

Types.—Holotype, male, and five male paratypes, Stanleyville, Congo, March, 1915, March 9, 1915, April, 1915, April 4, 6, 1915 (Lang and Chapin), two taken from *Bembez*. The holotype is labelled "March."

I have not been able to associate any females with this species.

### ***Sarcophaga fasciventris*, new species**

#### Figure 35

Black, cinereous pollinose; abdomen with a median vitta and the apices of the segments black, weakly tessellate. Length, 10.5 to 12 mm.

MALE.—Head dull silvery-white pollinose. Front about two-sevenths as wide as one eye; frontal bristles rather gently diverging opposite the antennae; ocellars moderately long and rather weak. Occiput white-haired, with two or three irregular rows of black bristly hairs behind the occipital cilia; cheeks with coarse black hair; parafacials with a partly double row of short black hairs. Palpi black. Antennae brown, the third segment more than twice as long as the second.

Thorax cinereous pollinose, the dark mesonotal vittae moderately narrow, the median one very narrow and extending as a brown stripe on to the scutellum. Acrosticals, 3-3; dorsocentrals, 3-3; sternopleurals, 1-1-1; three pairs of marginal scutellars, the apical pair weak; a weak pair of discals. Propleura bare.

Legs black, with cinereous pollen, the tibiae dark brownish-red, without long hairs; posterior femora with only one strong anteroventral bristle on the basal half.

Wings cinereous hyaline, but broadly tinged with brown along the veins. Squamae white, the disc of the lower lobe brown. Halteres pale orange.

Abdomen cinereous pollinose, a median vitta on the first three segments and the broad apices of the segments brown pollinose and appearing black, the fasciae more or less triangularly widened toward the sides but evanescent toward the lateral edges of the tergites. Genitalia small, black, cinereous pollinose, the first segment with or without a pair of apical hairlike bristles; forceps and claspers mostly reddish (Fig. 35).

Types.—Holotype, male, and paratype, male, Stanleyville, Congo, March, 1915 (Lang and Chapin), taken from *Bembez*.

### ***Sarcophaga binodosa*, new species**

#### Figure 38

Wings light brownish, the posterior border cinereous; tibiae without long hairs; genitalia small. Length, 11 mm.

MALE.—Head white pollinose. Front scarcely two-sevenths as wide as either eye; frontals diverging below; ocellars weak. Occiput with whitish pile and two or three irregular rows of black hairs behind the occipital cilia; hair of cheeks all black, rather fine. Parafacials with two rows of fine black hairs, the upper ones more brownish, two or three of the lower ones bristle-like but not long. Palpi brown. Third antennal segment twice as long as the second.

Thorax cinereous pollinose; mesonotal vittae moderately wide, the median one extending to beyond the middle of the scutellum. Acrosticals, 2 or 3-3; dorsocentrals, 3-3; sternopleurals, 1-1-1; propleura bare. Apical scutellars about as long as the discals.

Legs black, with cinereous pollen, the tibiae reddish brown, without long hairs; posterior femora with a few long hairs on each ventral edge.

Wings light brownish, the posterior border broadly cinereous. Squamae brownish with whitish border. Halteres yellow, the knob mostly brown.

Abdomen cinereous pollinose, a median vitta and the broad segmental apices broadly brown pollinose, appearing black, the dark bands slightly broadened toward the sides and continuing almost to the lateral edges of the tergites except on the first segment which is almost all dark dorsally. Genitalia small, black, yellowish-cinereous pollinose; arms of fifth sternite gently diverging. Lateral view of genitalia as in figure 38.

TYPE.—Male, Stanleyville, Congo, March, 1915 (Lang and Chapin), taken from *Bembez*.

### *Sarcophaga gnu*, new species

#### Figure 37

Three postsutural dorsocentrals; posterior tibiae with long hairs; abdomen tessellate. Length, 12 to 13 mm.

MALE.—Head whitish pollinose, in some views rather silvery. Front almost three-sevenths as wide as eye, the frontals diverging opposite the base of the antennae; ocellars very weak or absent. Occipital pile pale yellowish; several rows of black hairs behind the occipital cilia, cheeks with coarse black hair. Parafacials with two rows of hairs above and a single row of bristly hairs below. Palpi black. Antennae brown, the third segment twice as long as the second.

Thorax cinereous pollinose, the black mesonotal vittae strong and moderately wide, the median one extending almost to the apex of the scutellum. Acrosticals very poorly developed or absent, except the strong prescutellars; three strong postsutural dorsocentrals; sternopleurals, 1-1-1; propleura bare. Three pairs of marginal scutellars, the apicals long; one pair of long discals.

Legs black, with cinereous pollen; posterior tibiae dark brownish-red, with rather sparse long hairs on either ventral edge; posterior femora with the anteroventral bristles extending to the basal half.

Wings cinereous hyaline, sometimes with brownish tinge. Squamae white, the middle of the disc sometimes tinged with brown. Halteres yellow, the knob mostly reddish brown.

Abdomen with cinereous or yellowish-cinereous pollen, strongly tessellate; apices of segments narrowly dark; second segment without median marginals. Fifth sternite narrowly U-shaped, the edges with fairly numerous short bristles. Genitalia reddish, the first segment thinly pale pollinose and without bristles; second segment with some long, bristly hairs apically; lateral view of genitalia as in figure 37.

FEMALE.—Parafacials with irregular single row of hairs; front almost two-thirds as wide as eye; all the tibiae mostly brownish red; tibiae without long hairs; wings more strongly tinged with brown along the veins; apex of fourth abdominal segment sometimes dull reddish; genitalia wholly concealed from dorsal view, the genital opening wide, the sides with several bristles.

Types.—Holotype, male, and allotype, female, Stanleyville, Congo, March, 1915 (Lang and Chapin). Paratypes: seventeen males and four females, same data, all taken from *Bembez*.

***Sarcophaga maritima* Engel**

ENGEL, 1925, Bull. Soc. Roy. Ent. Egypt., (1924), p. 338.

Two males, Port Elizabeth, South Africa, February 25, 1919 (H. K. Munro).

An easily recognized species because of the shining black genital segments and the distinctive genitalia. It is evidently a coastal species and is known only from South Africa.

***Sarcophaga vicaria*, new species**

**Figure 22**

Posterior tibiae with a few long hairs; two sternopleurals; veins bordered with brown. Length, 12 to 13 mm.

MALE.—Head white pollinose, rather silvery. Front two-thirds as wide as eye; frontals strongly diverging below; ocellars rather short. Occipital pile pale yellowish; three rows of black hairs behind the occipital cilia; cheeks black-haired. Parafacials moderately wide, with numerous black hairs, three or four of the lower ones stout but not long. Palpi brown. Antennae brown, rather short, the third segment twice as long as the second.

Thorax cinereous pollinose, the dark mesonotal vittae of moderate width, the median one extending almost to the apex of the scutellum. Prescutellars long; two pairs of strong postsutural dorsocentrals and two or three weak pairs; sternopleurals normally 1-1, but there may be a third weak one below the anterior bristle; three or four pairs of marginal scutellars, the apical pair weak, the second pair sometimes very weak and little apparent.

Legs black, with cinereous pollen, the posterior four tibiae more or less castaneous; posterior tibiae with row of long, coarse hairs on the apical half of either ventral edge.

Wings cinereous hyaline, broadly bordered with light brown along the veins. Disc of squamae strongly tinged with brown. Halteres mostly reddish, the base of the knob tinged with brown.

Abdomen cinereous pollinose, strongly tessellate; second segment with a pair of strong median marginals. Arms of fifth sternite strongly divergent. Genitalia small, orange, the basal segment yellow pollinose and without bristles; lateral view of genitalia as in figure 22.

Types.—Holotype, male, Stanleyville, Congo, March, 1915; paratype, male, Stanleyville, April 7, 1915 (Lang and Chapin), both taken from *Bembez*.

***Sarcophaga villa*, new species**

**Figure 17**

Posterior tibiae weakly villous; second abdominal segment with weak marginals. Length, 8 to 11 mm.

MALE.—Head silvery-white pollinose. Front half as wide as eye; frontals



strongly diverging below; ocellars weak. Occiput white pilose, an irregular row of black hairs behind the cilia and a partial second row above; cheeks wholly black-haired. Parafacials with a single row of short black hairs, the lower ones stronger. Vibrissae situated level with the oral margin. Palpi black. Antennae brown, the third segment twice as long as the second.

Thorax cinereous pollinose, the black mesonotal vittae of moderate width, the median one extending almost to the apex of the scutellum. Acrosticals weakly developed, the prescutellar pair strong; four postsutural dorsocentrals; sternopleurals, 1-1-1; three pairs of marginal scutellars, the apical pair short and decussate; propleura bare.

Legs black, with cinereous pollen. Posterior tibiae conspicuously villous in large specimens, with much less long hair in small examples; posterior femora with at most one strong anteroventral bristle on the basal half.

Wings cinereous hyaline. Squamae white. Halteres brown on apical half.

Abdomen cinereous pollinose, strongly tessellate; second segment with a pair of moderately long, weak median marginals. Arms of fifth sternite diverging. Genitalia reddish, the first segment pale pollinose and bearing two or more bristly hairs behind. Lateral view of male genitalia as in figure 17.

Types.—Holotype, male, Victoria Falls, Southern Rhodesia, August, 1932 (A. Cuthbertson). Paratype, male, New Hanover, Natal, May 20, 1915 (C. B. Hardenberg).

### ***Sarcophaga chapini*, new species**

#### **Figure 34**

Posterior tibiae with long hairs on both lower edges; three pairs of postsutural dorsocentrals; genital segments reddish. Length, 12 mm.

MALE.—Head white pollinose, the face and front with strong brassy yellow tinge. Front slightly less than one-third as wide as one eye; frontals strongly diverging opposite the antennae; ocellars weak. Occipital pile very pale yellowish, two or three rows of black hairs behind the occipital cilia; hair of cheeks wholly black. Parafacials with a row of hairs near the eyes and three or four fine bristles below. Palpi brown. Antennae brown, the third segment twice as long as the second.

Thorax cinereous pollinose, the black mesonotal vittae of moderate width, the median one continued on to the scutellum. Acrosticals, 0-1; three pairs of postsutural dorsocentrals; sternopleurals, 1-1-1; two pairs of marginal scutellars, the apical pair absent; propleura bare.

Legs black, with cinereous pollen, the posterior tibiae with long hairs anteroventrally and villous behind.

Wings cinereous hyaline, the veins bordered with brown. Squamae white, the disc of the lower lobe brown. Halteres reddish yellow.

Abdomen cinereous pollinose, strongly tessellate; second segment with a pair of long median marginals. Fifth sternite with the arms diverging V-like, the inner edges with long bristly hairs basally and short ones apically. First genital segment mostly reddish, thinly pale pollinose, with several fine apical bristles. Lateral view of genitalia as in figure 34.

TYPE.—Male, Stanleyville, Congo (Lang and Chapin), taken from *Bembez*.

***Sarcophaga liberia*, new species**

Figures 27 and 28

Wings brownish, pale posteriorly; hind tibiae with long hairs; three pairs of postsutural dorsocentrals. Length, 11 to 14 mm.

MALE.—Head white pollinose, the parafrontals very narrow and rather dark above. Front slightly less than one-third as wide as either eye; frontals diverging below; ocellars short and weak. Occipital pile dull, pale yellowish, the hair black; cheeks with coarse black hair. Parafacials with a row of hairs and two or three moderately strong bristles below. Palpi black. Antennae brown, long, the third segment more than twice as long as the second. Vibrissae situated only slightly above the oral margin.

Thorax cinereous-white pollinose, the black mesonotal vittae rather wide, the median one distinctly the widest and continued almost to the apex of the scutellum. Acrosticals, 0-1; three pairs of strong postsutural dorsocentrals; sternopleurals, 1-1-1; propleura bare. Scutellum with three pairs of marginals, the apical pair decussate.

Legs black, with cinereous pollen; posterior tibiae villous.

Wings brownish, the posterior border cinereous; anterior cross-vein with distinct, narrow brown cloud. Squamae light brownish, the border and base pale yellowish. Halteres with brown knob.

Abdomen strongly tessellate, the pollen grayish with rich brownish tinge in some lights; second segment with a pair of strong median marginals. Arms of fifth sternite diverging V-like, the inner edges with moderately long bristly hairs. Genitalia small, the first segment blackish and rather thinly cinereous pollinose, with a pair of widely separated apical bristles; second segment shining reddish. Lateral and posterior views of the genitalia are shown in figures 27 and 28.

TYPES.—Holotype, male, Bakratown, Liberia, September 30. Paratypes: male, Bakratown, September 30; two males, Betala, Liberia, October 13; two males, Paiaia, Liberia, October 19; and male, Du River Camp No. 2, Liberia (J. Bequaert).

***Sarcophaga samia*, new species**

Figures 29 and 30

Very similar to *liberia*, new species, but with less strongly tessellate abdomen, paler wings, and different genitalia. Length, 8 to 14 mm.

MALE.—Head rather silvery-white pollinose, the parafrontals not dark above. Front five-twelfths as wide as either eye; frontal bristles moderately divergent opposite the base of the antennae; ocellars moderately long but weak. Occiput with dull yellowish-white hair and coarse black hairs. Cheeks clothed with coarse black hair. Parafacials with a single row of hairs and two or three weak bristles, or bristly hairs below, rarely with a rather strong bristle. Palpi black. Antennae brown, elongate, the third segment narrow and twice as long as the second. Vibrissae situated almost level with the oral margin.

Thorax cinereous pollinose, the black mesonotal vittae of moderate width, the median one not or but little wider than the outer ones. Acrosticals, 0-1; three pairs of strong postsutural dorsocentrals; three pairs of marginal scutellars, the apical pair decussate; propleura bare.

Legs black, with cinereous pollen, the posterior tibiae weakly villous.

Wings cinereous hyaline, the veins more or less strongly bordered with brown. Squamae white, in dark-winged specimens with the disc brownish or brown with yellowish border and white base. Knob of halteres brown.

Abdomen cinereous pollinose, moderately tessellate, the second segment with a pair of large median marginals. Arms of fifth sternite diverging V-like, with rather long, bristly hairs along the inner edges. Genitalia small, the first segment blackish and with thin cinereous pollen, its apex usually with a pair of stronger, bristly hairs. Lateral and posterior views of the genitalia are shown in figures 29 and 30.

FEMALE.—Front almost two-thirds as wide as either eye, the sides evenly diverging from the vertex; parafacials with two or three strong bristly hairs below. Tibiae without long hairs. Abdomen more strongly tessellate.

TYPES.—Holotype, male, Stanleyville, Congo, April 6, 1915; allotype, female, Monrovia, Liberia. Paratypes: five males, five females, Stanleyville, Congo, March and April 2, 9, 1915; four males and one female, Monrovia, Liberia.

The Congo specimens were collected by Lang and Chapin and were mostly taken from *Bembex*; the Liberian specimens were reared by Dr. J. Bequaert from decaying snails.

### *Sarcophaga dura*, new species

#### Figure 4

Palpi reddish; hind tibiae villous; two strong postsutural dorsocentrals. Length, 11.5 mm.

MALE.—Head white pollinose, the parafrontals wide, with brassy yellow tinge. Front two-thirds as wide as either eye; frontals but slightly diverging below; ocellars very weak and divergent. Occiput yellowish-white pilose, without black hairs behind the cilia; cheeks mostly white-haired. Parafacials wide, with scattered short, black hairs. Palpi pale reddish. Antennae rather short, brown, the second segment reddish, the third twice as long as the second. Vibrissae situated almost level with the oral margin.

Thorax yellowish-cinereous pollinose, the black mesonotal vittae rather dull, the median one narrow except where it extends on to the scutellum. Acrosticals, 0-1; two pairs of strong postsutural dorsocentrals, the other dorsocentrals short and mostly weak; sternopleurals, 1-1-1; three pairs of marginal scutellars, the apical pair weak and decussate.

Legs black, with cinereous pollen, the tibiae partly dark reddish, the posterior pair villous beneath.

Wings cinereous hyaline. Squamae white. Halteres reddish yellow.

Abdomen yellowish-cinereous pollinose, moderately tessellate. Arms of fifth sternite diverging U-like, the inner edges with black bristles. Genital segments reddish. Lateral view of genitalia as in figure 4.

HOLOTYPE.—Male, Monrovia, Liberia (J. Bequaert).

### *Sarcophaga langi*, new species

#### Figure 5

Posterior tibiae villous; second abdominal segment without median marginals. Length, 13 to 15 mm.

**MALE.**—Face and front cinereous-yellow pollinose, somewhat brassy. Front three-eighths as wide as one eye; frontals strongly diverging below; ocellars extremely weak or absent. Occiput white pollinose and with dull yellowish-tinged pile; a partial double row of black hairs behind the occipital cilia on the upper half of the head; cheeks whitish pilose, almost the upper half with black hairs. Parafacials with a row of fine hairs below and irregular hairs above on the sides. Palpi black. Antennae elongate, black, the third segment twice as long as the second. Vibrissae situated slightly above the oral margin.

Thorax cinereous pollinose, sometimes very strongly tinged with cinnamon brown, the black mesonotal stripes shining and rather broad, the median one extending almost to the apex of the scutellum. Acrosticals, 0-1; two or three pairs of strong posterior dorsocentrals, the others short and weak; sternopleurals, 1-1-1; three pairs of marginal scutellars, the apical pair weak and cruciate.

Legs black; posterior femora and tibiae villous beneath, the middle femora with long hair below.

Wings cinereous hyaline. Squamae whitish, the disc of the lower lobe usually tinged with brown. Halteres reddish yellow.

Abdomen with cinereous pollen, strongly tessellate, second segment without median marginals. Fifth sternite with the arms strongly divergent, their inner edges with short, rather fine hair. Lateral view of genitalia as in figure 5.

**TYPES.**—Holotype, male, and seven male paratypes, Stanleyville, Congo, March, April, 1915 (Lang and Chapin), taken from *Bembex*.

### ***Sarcophaga falciforceps* Villeneuve**

#### Figure 25

VILLENEUVE, 1929, Rev. zool.-bot. Afr., XVII, p. 250 (f.).

Two males, Stanleyville, Congo, August 8, 1909, and March, 1915; male, Garamba, Congo, July 1912 (Lang and Chapin), one taken from *Bembex*; four males, Burunga, Congo (J. Bequaert); male, Mazoe, Southern Rhodesia, June 11, 1927 (A. Cuthbertson), at *Poinsettia*.

This species was originally described from the Belgian Congo. It may be readily recognized by the structure of the male genitalia, shown in figure 25.

### ***Sarcophaga haemorrhoidalis* Fallén**

#### Figure 12

*Musca haemorrhoidalis* FALLÉN, 1816, 'Vet. Acad. Handl.,' p. 236.

Eight males and two females, Stanleyville, Congo, August 8, 20, 1909, and March and April, 1915; male, Faradje, Congo, November, 1912; male, Garamba, July, 1912; male, Boma, Congo, June 17, 1915 (Lang and Chapin), four taken from *Bembex*; male, Lukolela, left Bank Congo River, Congo, August 14, 1930 (J. P. Chapin); male Irebu, Congo, December 17, 1926 (J. Bequaert); two males, Monrovia, Liberia; male, Memeh Town, Liberia, August 29, 1926; two males, Gbanga,

Liberia, September, 1926; male, Kakatown, Liberia, August 20, 1926; male, Du River Camp No. 3, Liberia (J. Bequaert); male, Lomagundi, Southern Rhodesia, July, 1932 (A. Cuthbertson); male, Nieuwoudtville, Cape Province, South Africa, November 19 (Alice Mackie).

This common and widely distributed species apparently occurs over the greater part of Africa.

***Sarcophaga arno*, new species**

Figure 6

Posterior tibiae villous; genital segments reddish; second abdominal segment without median marginals. Length, 12.5 to 15 mm.

MALE.—Head white pollinose, the face and front more or less strongly brassy yellow. Front slightly more than three-sevenths as wide as either eye; frontals strongly diverging below; ocellars short and weak. Occipital pile yellowish; two or three rows of black hairs behind the occipital cilia; cheeks with black hair except behind. Parafacials with a row of hairs near the eyes and one or two irregular rows on the upper two-thirds. Palpi black. Antennae moderately long, the third segment more than twice as long as the second. Vibrissae situated a little above the oral margin.

Thorax cinereous pollinose, the black mesonotal vittae moderately wide and shining. Prescutellar acrosticals very weak or absent; two pairs of strong dorso-centrals, the others weak; sternopleurals, 1-1-1; three pairs of marginal scutellars. Propleura bare.

Legs black, with cinereous pollen; tibiae more or less brownish, the posterior pair villous below; middle femora with rather abundant long, erect hair on the basal two-fifths of the ventral surface, the posterior pair with erect shorter hair below.

Wings cinereous hyaline, the veins brown. Squamae white, the disc of the lower lobe with a brown spot. Halteres reddish yellow, the base of the knob more or less brownish.

Abdomen cinereous pollinose, strongly tessellate; second segment without median marginals. The arms of the fifth sternite leave a rather orbicular area, broadly open at the apex, the inner edges with numerous short, coarse hairs. Genital segments reddish, the first segment with two or three fine apical bristles. Lateral view of genitalia as in figure 6.

TYPES.—Holotype, male, Bejala, Liberia, October 13 (J. Bequaert). Paratypes: three males, Stanleyville, Congo, March, April 5, 1915 (Lang and Chapin), taken from *Bemex*.

***Sarcophaga burungae*, new species**

Figures 8 and 9

Propleura bare; second abdominal segment without dorsal bristles; acrosticals absent. Length, 12 mm.

MALE.—Head white pollinose, the front darker and rather dull, in most lights with a black spot extending from the base of the antennae to the orbits. Front more than half as wide as either eye, the sides parallel on the upper half; frontals strongly diverging below; ocellars moderately long and fine. Occiput white pilose, with at

most two partial rows of black hairs behind the occipital cilia; cheeks three-eighths as wide as the eye-height, white-haired on the posterior half except above. Parafacials with a row of black hairs, all about equally strong. Vibrissae situated almost level with the oral margin. Palpi and antennae black, the antennae of moderate length, the third segment a little more than twice as long as the second.

Thorax cinereous-white pollinose, moderately hairy, the black mesonotal vittae rather wide; no acrosticals; two pairs of strong postsutural dorsocentrals and two or three weak pairs; three pairs of marginal scutellars, the apical pair weak and decussate; sternopleurals, 1-1-1.

Legs black, with cinereous pollen; middle and posterior femora with thick hair below, the posterior tibiae villous on the lower surface.

Wings cinereous hyaline. Squamae white, the disc of the lower lobe brown. Halteres with yellow knob, the stem mostly brownish red.

Abdomen cinereous-white pollinose, strongly tessellate; second segment without median marginals, the third with a weak pair. Fifth sternite with a deep U-shaped incision, the inner edges with numerous bristly hairs or fine bristles. First genital segment brown, with two or three pairs of apical bristles; second segment reddish. Lateral view of genitalia as in figure 9.

HOLOTYPE.—Male, Burunga, Congo (J. Bequaert).

### *Sarcophaga beckeri* Villeneuve

Figures 14 and 15

VILLENEUVE, 1908, Mitt. Zool. Mus. Berlin, IV, p. 122 (f.).

Ten males, Stanleyville, Congo, March, 1915; seventeen males, Stanleyville, April, 2, 4, 5, 7, 8, 10, 11, 12, 16, 22, and 27, 1915 (Lang and Chapin), mostly taken from *Bembez*; male, Eden, Camaroons (J. A. Reis).

This species was originally described from the Canary Islands and, although I have no specimens from there, the identification is probably correct, since Villeneuve figured the genitalia.

### *Sarcophaga garbo*, new species

Figure 10

Posterior tibiae villous; propleura bare; second abdominal segment without median marginals. Length, 13 to 14 mm.

MALE.—Head whitish pollinose, the face and front strongly tinged with brassy yellow. Front three-sevenths as wide as either eye; frontals gently diverging opposite the antennae; ocellars rather short and fine. Occipital pile yellow; black hair behind the occipital cilia, the yellow pile encroaching on to the black-haired cheeks. Parafacials with a row of fine hairs near the eyes and scattered hairs above. Palpi black. Antennae black, long, the third segment obviously more than twice as long as the second. Vibrissae situated practically level with the oral margin.

Thorax cinereous pollinose, sometimes with strong yellowish or cinereous brown tinge dorsally; black mesonotal vittae wide and shining. Acrosticals, 0-1; two pairs of strong postsutural dorsocentrals, the others much shorter but moderately strong; sternopleurals, 1-1-1; three or four pairs of marginal scutellars.

Legs black, with cinereous pollen; posterior tibiae with villous hair antero-ventrally; middle femora villous beneath to beyond the middle where the hair is very long and ends abruptly, the posterior femora not densely haired below.

Wings cinereous hyaline, the veins more or less distinctly bordered with pale brownish. Squamae tinged with brown, with white border and base, rarely mostly white. Halteres reddish yellow.

Abdomen cinereous pollinose, strongly tessellate; apex of fourth segment more or less reddish; second segment without median marginals. Arms of fifth sternite diverging V-like, the inner edges with short, bristles. Lateral view of genitalia as in figure 10.

Types.—Holotype, male, Stanleyville, Congo, April 7, 1915. Paratypes: three males, Stanleyville, March, 1915 (Lang and Chapin), taken from *Bembex*; male, Reppo's Town, Liberia, September (J. Bequaert).

### ***Sarcophaga inzi*, new species**

Figure 19

Propleura bare; posterior tibiae villous; second abdominal segment without dorsal bristles. Length, 9 to 12 mm.

Male.—Head white pollinose, the parafrontals with brassy yellow tinge. Front half as wide as either eye; frontal rows strongly diverging below; ocellars of medium length. Occiput and posterior half of the cheeks with white, yellowish-tinged hair, without black hairs behind the occipital cilia. Parafacials with a row of fine hairs ending in one or two coarse ones below. Vibrissae distinctly approximated, situated very slightly above the oral margin. Palpi brown. Antennae reddish brown, the third segment a little more than twice as long as the second.

Thorax cinereous pollinose, the black mesonotal vittae of medium width. Pre-scutellar acrosticals long and strong, the others wholly absent; two pairs of strong dorsocentrals, the others scarcely or not at all differentiated; sternopleurals, 1-1-1; three pairs of marginal scutellars, the apical pair weak and decussate.

Legs black, the femora with cinereous pollen; tibiae reddish or brownish, the posterior pair villous beneath.

Wings cinereous hyaline. Squamae white, the disc with a transverse brown spot extending to the outer edge. Halteres with brown knob.

Abdomen cinereous pollinose, wholly black; first genital segment reddish brown, the second reddish. Lobes of fifth sternite with rather parallel sides and perpendicular on basal half, convex apically, the inner edge with erect coarse spines, the apex of the lobe with some long hairs and a strong bristle. Lateral view of genitalia as in figure 19.

Types.—Holotype, male, Stanleyville, Congo, April 7, 1915; seven males, paratypes, Stanleyville, September, 1912, and March, 1915 (Lang and Chapin), mostly taken from *Bembex*.

### ***Sarcophaga mulaba*, new species**

Figure 16

Propleura bare; posterior tibiae villous below; fourth abdominal segment reddish on apical third or more. Length, 10 to 13 mm.

Male.—Head white pollinose, the parafrontals with brassy yellow tinge. Front

slightly more than half as wide as either eye, the frontal rows strongly diverging below; ocellars rather short. Occiput with fine yellowish white hair, with a row of black hairs behind occipital cilia on the upper fourth. Cheeks pale-haired on the posterior half. Parafacials with a row of short black hairs. Vibrissae situated level with the oral margin. Palpi brown with the basal half reddish. Antennae short, the third segment barely twice as long as the second.

Thorax cinereous pollinose, the black mesonotal vittae narrow. Prescutellar acrosticals fine, the others absent; two pairs of strong postsutural dorsocentrals, the others poorly differentiated; three sternopleurals, the second situated near the first; scutellum with three pairs of marginals, the apical pair weak and decussate.

Legs black, the tibiae reddish or reddish brown, the femora with cinereous pollen; posterior tibiae with long hairs on both lower edges.

Wings cinereous hyaline. Squamae white, usually with a small brown spot on the disc. Halteres yellow, the base of the knob reddish brown.

Abdomen with whitish pollen, strongly tessellate; second segment without dorsal bristles. Lobes of fifth sternite moderately diverging, the inner edges densely clothed with short, coarse setulae. Genital segments orange, without bristles. Lateral view of genitalia as in figure 16.

**FEMALE.**—Front about two-thirds as wide as either eye; palpi very large and swollen; no apical scutellars; usually four sternopleurals in a straight line; tibiae without long hairs; first genital segment broadly arched, the marginal bristles on the sides preceded by two irregular rows of hairs.

**TYPES.**—Holotype, male, and allotype, female, Stanleyville, Congo, March, 1915; five males and three females, paratypes, Stanleyville, March and April, 1915 (Lang and Chapin), all taken from *Bembez*.

The name "mulaba" is Kingwana for "stripe." The female may be readily recognized by the large, swollen palpi and partly red fourth abdominal segment. In the male the palpi are large but are not so conspicuously swollen.

### *Sarcophaga musitali*, new species

Figure 40

Propleura bare; posterior tibiae villous; fourth abdominal segment broadly red apically. Length, 9.5 to 11 mm.

**MALE.**—Head white pollinose, the parafrontals usually with brassy yellow tinge. Front one-third as wide as either eye, the frontal rows moderately diverging below; ocellars moderately strong. Occiput white-haired, with a row of coarse black hairs behind the occipital cilia. Cheeks white-haired on the posterior half. Parafacials with a row of fine black hairs ending in two or three coarse ones below. Vibrissae situated level with the oral margin. Palpi brown, the base sometimes reddish. Antennae moderately short, the third segment twice as long as the second.

Thorax white pollinose, the black mesonotal vittae rather narrow. Prescutellar acrosticals long and fine, the others absent; two pairs of strong postsutural dorso-centrals, the others very weak; three evenly spaced sternopleurals; scutellum with three pairs of marginals, the apical pair weak and decussate.

Legs black, the tibiae reddish or reddish brown, the posterior pair with long hairs on both ventral edges but they are less numerous and shorter in front.



Wings cinereous hyaline. Squamae white, with the disc more or less pale brown. Halteres reddish yellow, the base of the knob brownish.

Abdomen with white pollen, strongly tessellate, the second segment without dorsal bristles. Lobes of fifth sternite diverging V-like, the inner edges armed with long, rather fine setulae or short, coarse hairs. Broad apex of fourth abdominal segment and the genital segments orange, the latter without bristles. Lateral view of male genitalia as in figure 40.

FEMALE.—Front a little narrower than either eye, the sides gently diverging from the vertex to the antennae; parafrontals white pollinose; no apical scutellars; tibiae without long hairs. Genital segments shining red, the first broadly arched above, bare except for the bristles along the sides of the genital opening.

TYPES.—Holotype, male, allotype, female, and two male paratypes, Stanleyville, Congo, March, 1915 (Lang and Chapin), taken from *Bembez*, and one paratype, male, Eden, Cameroon (J. A. Reis).

The name of the species is the Kingwana word meaning "a line."

### *Sarcophaga afra*, new species

#### Figure 2

Propleura haired; hind tibiae villous posteriorly; mesonotal vitta: wide. Length, 10 to 15 mm.

MALE.—Head pale yellowish pollinose, the occiput whitish. Front three-eighths as wide as either eye; frontals moderately diverging below; ocellars weak. Pile of the occiput pale yellowish; about two rows of black hairs behind the occipital cilia; cheeks black-haired, with pale hair behind. Parafacials with two converging rows of fine hairs above and a single row of stout hairs below. Palpi black. Antennae brown, elongate, the third segment almost three times as long as the second. Vibrissae situated a little above the oral margin.

Thorax cinereous pollinose, the black mesonotal vittae broad. Prescutellar acrosticals long; two pairs of long dorsocentrals, the others short; sternopleurals, 1-1, or 1-1-1; three pairs of marginal scutellars.

Legs black; posterior tibiae villous posteriorly; middle and hind femora with abundant hair below.

Wings cinereous hyaline. Squamae white, the disc slightly tinged with brown. Halteres dull reddish, the base of the knob somewhat darkened.

Abdomen cinereous pollinose, strongly tessellate; second segment without median marginals. Arms of fifth sternite strongly diverging beyond the basal third, their inner edges with abundant, rather short, bristly hair. Lateral view of genitalia as in figure 2.

FEMALE.—Front seven-ninths as wide as either eye, the sides gently widening from the vertex forward; tibiae without long hairs; scutellum without apical bristles; genital segments reddish.

TYPES.—Holotype, male, allotype, female, Stanleyville, Congo, March, 1915. Paratypes: four males, six females, Stanleyville, March, 1915, male and female, April, 1915, male, May, 1915, and female, July 7, 1915 (Lang and Chapin), mostly taken from *Bembez*.

***Sarcophaga momba*, new species**

## Figure 26

Propleura haired; wings tinged with brown; posterior tibiae with long hairs. Length, 9 to 12.5 mm.

MALE.—Head white pollinose, the face and front with yellow tinge. Front one-third as wide as either eye; frontals strongly diverging opposite the base of the antennae; ocellars short. Occiput with pale yellowish pile, several rows of black hairs behind the occipital cilia. Cheeks wholly black-haired; parafacials with a row of hair near the orbits and three or four strong bristly hairs below. Vibrissae situated almost on a level with the oral margin. Palpi and antennae brown, the third antennal segment decidedly more than twice as long as the second.

Thorax cinereous pollinose, sometimes with yellowish tinge, the black vittae moderately broad. Prescutellar acrosticals absent; two pairs of strong postsutural dorsocentrals and sometimes one or two weaker pairs; three pairs of marginal scutellars, the apical pair weaker and decussate.

Legs black, the femora with cinereous pollen; tibiae more or less dark reddish; posterior tibiae with long hairs on both lower edges.

Wings cinereous hyaline, broadly tinged with brown along the veins. Squamae white, usually with a small brownish area on the disc. Knob of halteres brown.

Abdomen cinereous pollinose, tessellate. Fifth sternite not divided, gently produced and densely short spinose in the middle. Second genital segment with from four to eight strong bristles apically. Lateral view of male genitalia as in figure 26.

FEMALE.—A single female agrees with the males but lacks long hair on the tibiae and the genital segments are dull reddish and mostly concealed. The front is about half as wide as one eye and gradually widens from the vertex forward.

TYPES.—Holotype, male, allotype, female, and male paratype, Stanleyville, March, 1915, and male paratype, Stanleyville, April 7, 1915 (Lang and Chapin), all taken from *Bembez*.

***Sarcophaga alina*, new species**

## Figure 18

Propleura haired; acrosticals absent; posterior tibiae with long hairs. Length, 11 to 12.5 mm.

MALE.—Head cinereous-white pollinose, with brassy tinge. Front three-eighths as wide as either eye; frontals gently diverging below; ocellars absent. Occiput and cheeks black-haired, the former with dull yellowish pile below the neck. Parafacials with an irregular row of short hairs and two or three fine bristles below. Palpi black. Antennae long, the third segment almost four times as long as the second. Vibrissae situated level with the oral margin.

Thorax cinereous pollinose, the black mesonotal vittae of moderate width. Acrosticals wholly absent, the dorsocentrals weak with the exception of the posterior pair. Three pairs of marginal scutellars, the apical pair decussate, the discals situated close to the margin and slightly weaker than the apicals. Three sternopleurals in an almost straight line.

Legs black, the femora with cinereous pollen; posterior tibiae with long hairs on both ventral surfaces.

Wings cinereous hyaline, more or less tinged with brown along the veins and

sometimes quite brownish. Squamae white, the lower lobe more or less tinged with brown on the apical half. Halteres reddish yellow, the base of the knob brownish.

Abdomen cinereous pollinose, moderately tessellate; second segment with a pair of strong median marginals. Fifth sternite not divided but with a shallow angular median notch, the apex with dense short spines except laterally. Genital segments reddish, the first with three or four pairs of apical bristles. Lateral view of genitalia as in figure 18.

FEMALE.—Agrees with the male, but the tibiae lack long hairs. Genitalia reddish, the first segment pale pollinose and with one or two lateral bristles apically.

TYPES.—Holotype, male, allotype, female, Stanleyville, Congo, March, 1915. Paratypes: five males and one female, Stanleyville, March and April, 1915 (Lang and Chapin).

### *Sarcophaga furcadorsalis* Rohdendorf

#### Figure 24

ROHDENDORF, 1931, Ann. Mag. Nat. Hist., VIII, p. 350 (f.).

Two males and four females, Stanleyville, March, 1915 (Lang and Chapin), taken from *Bembez*.

Lateral view of the male genitalia is shown in figure 24.

### *Sarcophaga kisangani*, new species

#### Figure 20

Propleura haired; second abdominal segment without dorsal bristles; posterior tibiae villous. Length, 11 mm.

MALE.—Head white pollinose, the parafacials and front with brassy-yellow tinge. Front almost half as wide as either eye; frontal rows diverging below; ocellars short and rather fine. Occiput with dull yellowish pile; three rows of black hairs behind the occipital cilia, the yellow pile encroaching on the cheeks below. Parafacials with a row of hairs and two or three bristles below. Vibrissae situated level with the oral margin. Palpi black. Antennae black, the third segment missing.

Thorax cinereous pollinose, the black mesonotal vittae of medium width. Acrosticals wholly absent; two pairs of strong postsutural dorsocentrals and two or three pairs of weak ones; three pairs of marginal scutellars, the apical pair very weak and decussate; three strong, evenly spaced sternopleurals.

Legs black, with cinereous pollen, the posterior four tibiae largely castaneous, the posterior pair villous below.

Wings cinereous hyaline, the veins weakly bordered with brown. Squamae whitish, the disc of the lower lobe tinged with yellow, the upper lobe with yellow rim.

Abdomen with cinereous pollen; second segment without median marginals, the third with four pairs across the apex. Fifth sternite with the base produced downward, the arms strongly diverging, clothed with short, fine hairs on the inner edges. Genitalia small, the first segment concealed, the second dark reddish. Lateral view of genitalia as in figure 20.

HOLOTYPE.—Male, Stanleyville, April 11, 1915 (Lang and Chapin), taken from *Bembez*.

The Kingwana name for Stanleyville has been used for this species. The literal translation is "on the island."

***Sarcophaga bulamatadi*, new species**

Figure 41

Propleura haired; posterior tibiae villous; second abdominal segment without dorsal bristles. Length, 13.5 mm.

MALE.—Head white pollinose, the face and front with strong brassy tinge. Front five-twelfths as wide as either eye, widening anteriorly from the posterior third; frontal rows moderately diverging below; ocellars weak. Occiput with black hair, the pile below the neck, and surrounding it, pale yellowish; cheeks with rather long black hair, especially below. Parafacials with a row of four or five hairs and two or three weak bristles below. Vibrissae situated level with the oral margin. Palpi black. Antennae black or brown, the third segment missing.

Thorax cinereous pollinose, the black mesonotal vittae of medium width. No acrosticals; two pairs of strong postsutural dorsocentrals, the others weak; three pairs of marginal scutellars, the apical pair weak and decussate. Propleura haired in the middle.

Legs black, with cinereous pollen, the posterior four tibiae more or less brown or castaneous; posterior tibiae with long hairs on both lower edges.

Wings cinereous hyaline, the veins more or less bordered with brown. Squamae white, the disc tinged with brown. Knob of halteres mostly brown.

Abdomen with cinereous pollen, strongly tessellate; second segment without dorsal bristles, the third with a pair of long median marginals. Fifth sternite rather strongly produced downward on the basal half, the arms diverging V-shaped and with very short, fine hairs on their inner edges. First genital segment black, the second reddish. Lateral view of genitalia as in figure 41.

HOLOTYPE.—Male, Stanleyville, Congo, April 7, 1915 (Lang and Chapin), taken from *Bembex*.

I have applied to this species the native name for Stanley, the great African explorer.

***Sarcophaga surda*, new species**

Figure 13

Propleura haired; posterior tibiae villous; prescutellar acrosticals weak or absent. Length, 12 to 13 mm.

MALE.—Head white pollinose, sometimes with brassy yellow tinge. Front three-sevenths as wide as either eye; ocellars short and fine; frontals not strongly divergent below. Occiput with black hair, the pile below the neck pale yellowish. Parafacials with a row of hairs and three or four bristles below. Palpi black. Antennae brown, the third segment less than three times as long as the second. Vibrissae situated level with the oral margin.

Thorax cinereous pollinose, the black mesonotal vittae moderately wide. Two pairs of strong postsutural dorsocentrals and two or three weak pairs; three evenly spaced sternopleurals; three pairs of marginal scutellars, the apical pair weaker and decussate.

Legs black, the femora with cinereous pollen; tibiae rather castaneous, the posterior pair villous beneath.

Wings cinereous hyaline, at most weakly tinged with brown along the veins. Squamae white, the disc of the lower lobe more or less pale brown. Halteres with brown knobs.

Abdomen cinereous pollinose, strongly tessellate; second segment without median marginals. Fifth sternite with the lobes moderately separated, their inner edges almost parallel and rather triangularly produced, the apices with rather dense bristles. Genitalia reddish, the basal segment sometimes with brown tinge, without bristles. Lateral view of genitalia as in figure 13.

FEMALE.—Apical scutellars absent; tibiae without long hair. Genital segments reddish, the first segment not creased above and with rather strong apical bristles.

Types.—Holotype, male, allotype, female, Stanleyville, Congo, March, 1915; three males and one female, paratypes, Stanleyville, March and April, 1915 (Lang and Chapin), taken from *Bembez*.

### *Sarcophaga inducta*, new species

#### Figure 12

Propleura haired; posterior tibiae with long hair below; second abdominal segment without median marginals. Length, 12.5 mm.

MALE.—Head white pollinose. Front a little less than half as wide as either eye; frontal bristles moderately diverging opposite the base of the antennae; ocellars rather weak. Occiput with black hair, the pile below the neck pale yellowish. Para-facials with a row of short hairs and three or four fine bristles below. Palpi black. Antennae brown, long, the third segment somewhat more than twice as long as the second. Vibrissae situated on a level with the oral margin.

Thorax cinereous pollinose, the median black mesonotal vitta rather narrow. Prescutellar pair of acrostical bristles well developed, the others not clearly differentiated; two pairs of strong postsutural dorsocentrals and two or three weak ones. Sternopleurals in a straight line, evenly spaced. Three pairs of marginal scutellars and a pair of weak preapicals.

Legs black, the femora with cinereous pollen; tibiae rather brownish, the posterior pair with long hair on either lower edge.

Wings light brownish, the broad apical and posterior borders cinereous hyaline. Squamae white, with yellow border. Halteres with brown knobs.

Abdomen cinereous pollinose, strongly tessellate, the second segment without median marginals. Fifth sternite divided on the apical half, the base somewhat keeled, the arms rather widely separated, the apices oblique and with numerous, fine, short bristles. Basal genital segment brown, cinereous pollinose, bearing two or three pairs of fine apical bristles; second segment orange. Lateral view of genitalia as in figure 12.

HOLOTYPE.—Male, Stanleyville, Congo, March, 1915 (Lang and Chapin), taken from *Bembez*.

**Poecilometopa Villeneuve**

VILLENEUVE, 1913, Bull. Soc. Ent. France, p. 348.

This name was proposed by Villeneuve for the reception of *Angiometopa dinidiatipes*, described on page 347 of the reference cited. All the species thus far included have at least one strong blackish spot on the wing and most of them have three or four. Malloch would retain the species in *Sarcophaga*, but there are apparently sufficiently good characters for their segregation, and I have followed Villeneuve, pending a thorough revision of the genera in the family.

**Poecilometopa notatipennis Austen**

Figure 21

*Sarcophaga notatipennis* AUSTEN, 1909, Trans. Zool. Soc. London, p. 98.

?*Sarcophaga octomaculata* JAENNICKE, 1867, Abhandl. Senkenb. Gesellsch., VI, p. 379.

Austen described and figured the adult of this species from Ruwenzori but, since the male genitalia were not figured, the identification of the species must remain in doubt. Jaennecke described only the female, and the female before me differs from his description only in having the mesonotal vittae more distinct.

Two males and one female, Burunga, Congo (J. Bequaert).

**Poecilometopa punctipennis Malloch**

*Sarcophaga punctipennis* MALLOCH, 1928, Ann. Mag. Nat. Hist., II, p. 325.

It seems likely that this name applies to *notatipennis* Austen.

**Poecilometopa congensis, new species**

Figure 33

Propleura haired in the middle; wings each with three large and one small, dark brown spots; genitalia orange. Length, 10 mm.

MALE.—Head silvery pollinose, the parafacials and parafrontals changing in different views. Front a little more than half as wide as either eye; frontal rows strongly diverging below; ocellars long and strong; parafrontals very narrow above, the frontal vitta thinly dusted with whitish pollen. Occiput black-haired, only a few fine white hairs below the neck. Parafacials wide, with four bristles and several long hairs below and a few short hairs above. Vibrissae situated level with the oral margin. Palpi black. Antennae black, the third segment hardly one-half longer than the second.

Thorax blue-black, with rather thin white pollen, the black vittae wide and brown pollinose. No acrosticals; two pairs of strong postsutural dorsocentrals and three scarcely differentiated pairs, the presuturals with only the posterior pair well differentiated but short; three pairs of marginal scutellars, the apical pair weak and decussate; sternopleurals three, evenly spaced and strong. Irregular swelling on the pleura in front of the base of the wings orange.

Legs black, with thin cinereous pollen, the femora with long, rather sparse hair below; posterior tibiae with long hairs on both lower edges.

Wings cinereous hyaline, with blackish-brown spots on the anterior and posterior cross-veins, and on the bend of the fourth vein and a less distinct brown spot on the origin of the second vein. Squamae white, the disc of the lower lobe brown. Halteres brownish red, the knob yellow.

Abdomen evenly and thinly gray pollinose, with a median vitta and lateral black spots on the second to fourth segments, the second segment without dorsal bristles. Lobes of the fifth sternite very narrowly separated, their margins with short, dense, appressed spines, the apices with longer, fine bristles. First genital segment shining black, the second orange; posterior forceps black, the outer pair reddish. Lateral view of genitalia as in figure 33.

HOLOTYPE.—Male, Burunga, Congo (J. Bequaert).

### ***Poecilometopa spilogaster* Wiedemann**

Figure 7

*Sarcophaga spilogaster* WIEDEMANN, 1830, 'Ausser. Zweifl.' II, p. 362.

Like the preceding species, *spilogaster* has the second genital segment red and the first shining black, but the color is yellowish cinereous, the dark mesonotal vittae, in the female, are almost obsolete, and the general color is quite dull. Lateral view of male genitalia is shown in figure 7.

Male, Inyanga, Southern Rhodesia, November, 1933 (A. Cuthbertson); two females, South Africa, January, 1925.

### ***Helicobia alerta*, new species**

Figure 39

Propleura bare; second abdominal segment with a pair of long median marginals; posterior tibiae with a few long hairs. Length, 6 mm.

MALE.—Head cinereous-yellow pollinose, black-haired, the occiput with yellowish pile below the neck. Front three-eighths as wide as either eye; frontal rows strongly diverging below; ocellars long. Vibrissae situated level with the oral margin. Palpi and antennae brown, the third antennal segment one-half longer than the second.

Thorax with cinereous-yellow pollen, the black mesonotal vittae of moderate width. Prescutellar acrosticals long, the others not clearly differentiated; three pairs of strong postsutural dorsocentrals; three strong, evenly spaced sternopleurals; scutellum with three pairs of marginals, the apical pair weak and decussate.

Legs black, with cinereous pollen; tibiae more or less brownish red, the posterior pair with a few long bristly hairs on the anteroventral surface and more numerous ones posteroventrally.

Wings cinereous hyaline. Squamae white. Halteres yellow.

Abdomen yellowish-cinereous pollinose, weakly tessellate, the brown median vitta distinct; second segment with a pair of strong median marginals. Lobes of fifth sternite strongly diverging, without dense hairs or bristles. Genitalia reddish yellow, the first segment more or less brownish. Lateral view of genitalia as in figure 39.

HOLOTYPE.—Male, Umdazani, Cape Province, May 29, 1924 (H. K. Munro).

The specimen is teneral and the colors cannot be positively determined.

***Helicobia selene*, new species**

Figure 36

Propleura bare; three postsutural dorsocentrals; second abdominal segment with a pair of large median marginals. Length, 10 mm.

MALE.—Head white pollinose, the cheeks and occiput with yellow tinge. Front half as wide as either eye, the frontal rows strongly diverging below; ocellar bristles moderately long. Occiput with coarse, black hair, yellow pilose below the neck. Cheeks with coarse black hair. Parafacials with a few fine hairs above and two or three weak bristles below. Vibrissae situated almost level with the oral margin. Palpi black. Antennae brown, the third segment decidedly less than twice as long as the second.

Thorax with cinereous-yellow pollen, the mesonotum sometimes with a brownish tinge, the black vittae rather narrow. Only the prescutellar pair of acrostical bristles clearly differentiated, although the presuturals are slightly stronger than the surrounding hairs. Three pairs of strong postsutural dorsocentrals; scutellum with three pairs of marginals, the apical pair weaker than the others and decussate; three evenly spaced, strong sternopleurals.

Legs black, with cinereous pollen, the tibiae brownish or reddish, the posterior pair villous beneath.

Wings cinereous hyaline, the veins blackish. Squamae white, with luteous border. Halteres yellow.

Abdomen with yellowish-cinereous pollen, strongly tessellate. Lobes of fifth sternite strongly diverging except at the base, armed on the inner edge with numerous short bristles. Genital segments reddish, the first with a dark preapical spot above and with a row of weak apical bristles. Lateral view of genitalia as in figure 36.

TYPES.—Holotype, male, East London, South Africa, February 23, 1924; male, paratype, East London, February 22, 1925 (H. K. Munro). The holotype has been returned to Mr. Munro.

***Helicobia monroi*, new species**

Figure 23

Propleura haired; second abdominal segment without long bristles; posterior tibiae with only short hair. Length, 6 to 7 mm.

MALE.—Head silvery-white pollinose, in some views with dark areas. Front two-fifths as wide as either eye; frontals strongly diverging below; ocellars rather short. Occiput with coarse black hair, below the neck with white pile. Cheeks wholly black-haired. Parafacials with a row of hairs ending in two or three weak bristles below. Vibrissae situated level with the oral margin. Palpi and antennae brown, the third antennal segment a little more than twice as long as the second.

Thorax cinereous pollinose, the mesonotal vittae rather narrow. Prescutellar acrosticals weak, the others absent; three pairs of strong postsutural dorsocentrals and three evenly spaced sternopleurals; scutellum with three pairs of marginal bristles, the apical pair weak and decussate.

Legs black, with cinereous pollen; tibiae brown, without long hairs.



Wings cinereous hyaline. Squamae white. Halteres reddish, the base of the knob darkened.

Abdomen cinereous pollinose, strongly tessellate, the second segment without dorsal bristles. Arms of the fifth sternite diverging V-like, the inner edges with short, stout bristly hairs. First genital segment brown, the second orange. Lateral view of genitalia as in figure 23.

FEMALE.—Agrees with the male but there are often fewer hairs on the middle of the propleura. The genital segments are shining orange, the first sharply arched above and with black bristles on the sides, the disc bare.

TYPES.—Holotype, male, Salisbury, Southern Rhodesia, May, 1929 (A. Cuthbertson); allotype, female, Pretoria, South Africa, September 2, 1913 (H. K. Munro). Paratypes: male, Salisbury, May, 1929 (Cuthbertson); male, New Hanover, Natal, November 24, 1913 (C. B. Hardenberg); female, Port Elizabeth, Natal, February 24, 1919 (H. K. Munro).

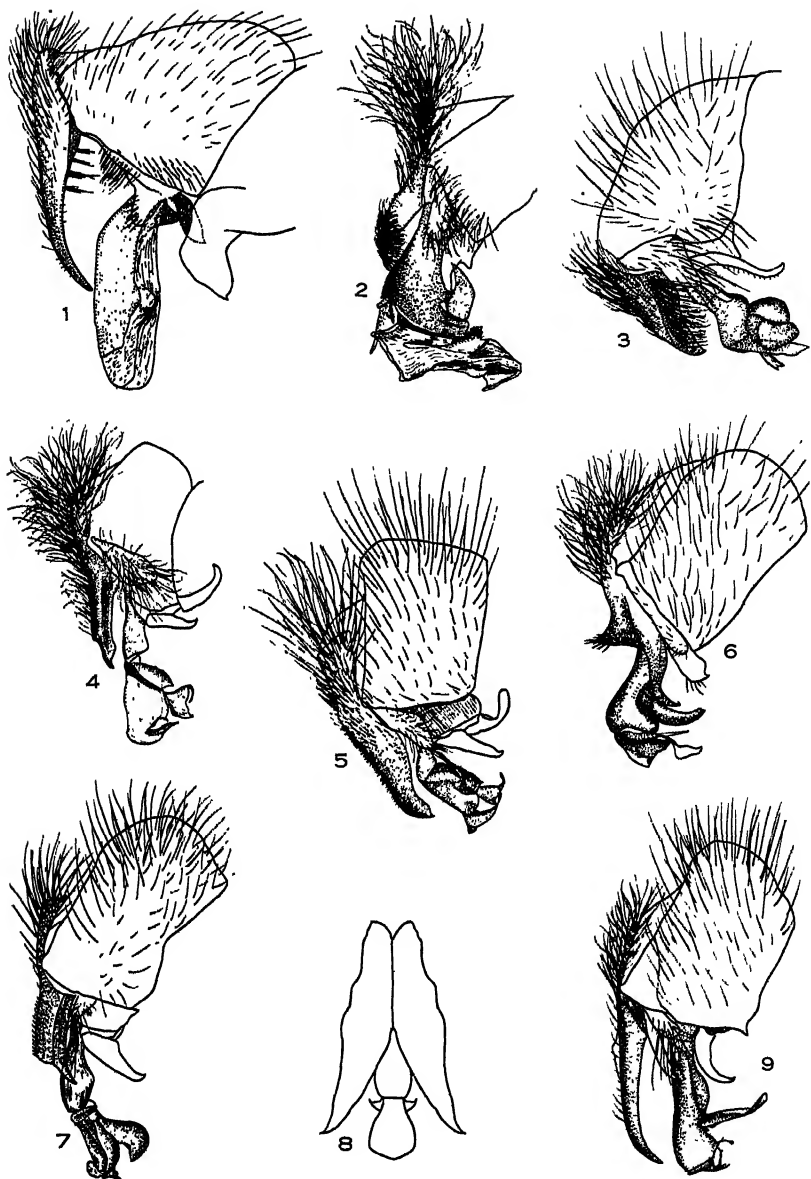


Fig. 1. *Wohlfahrtia euvittata* Villeneuve.

Fig. 2. *Sarcophaga afra*, new species.

Fig. 3. *Agria ? condona*, new species.

Fig. 4. *Sar.ophaga dura*, new species.

Fig. 5. *Sarcophaga langi*, new species.

Fig. 6. *Sarcophaga aron*, new species.

Fig. 7. *Poecilometopa spilogaster*  
Wiedemann.

Fig. 8. *Sarcophaga burungae*, new species.

Fig. 9. *Sarcophaga burungae*, new species.

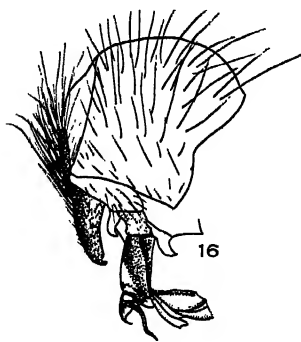
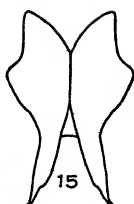
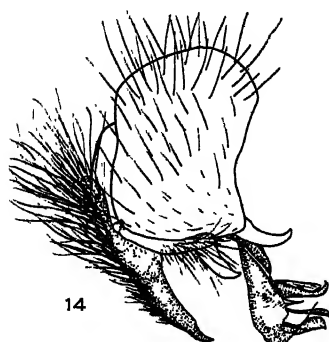
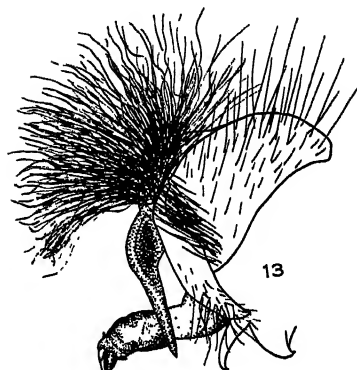
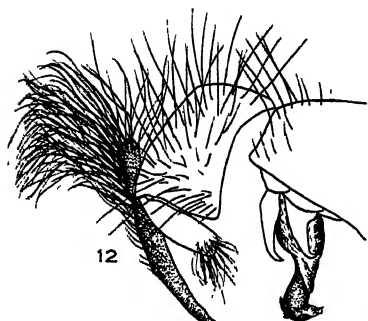
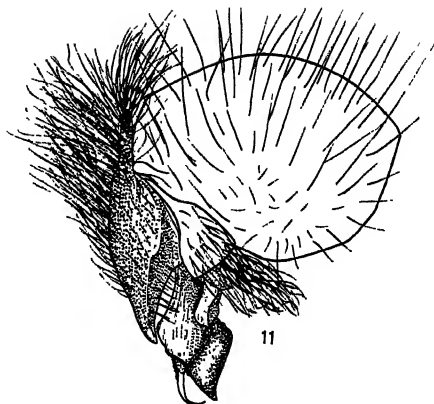
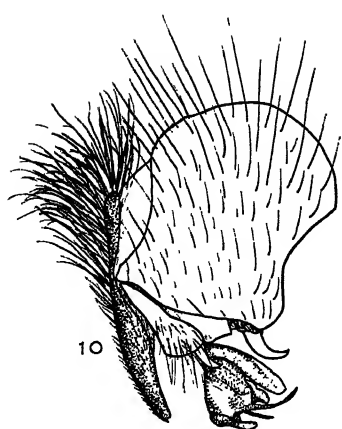


Fig. 10. *Sarcophaga garbo*, new species.

Fig. 11. *Agria? mumroi* Curran.

Fig. 12. *Sarcophaga inducta*, new species.

Fig. 13. *Sarcophaga surda*, new species.

Fig. 14. *Sarcophaga beckeri* Villeneuve.

Fig. 15. *Sarcophaga beckeri* Villeneuve.

Fig. 16. *Sarcophaga mulaba*, new species.

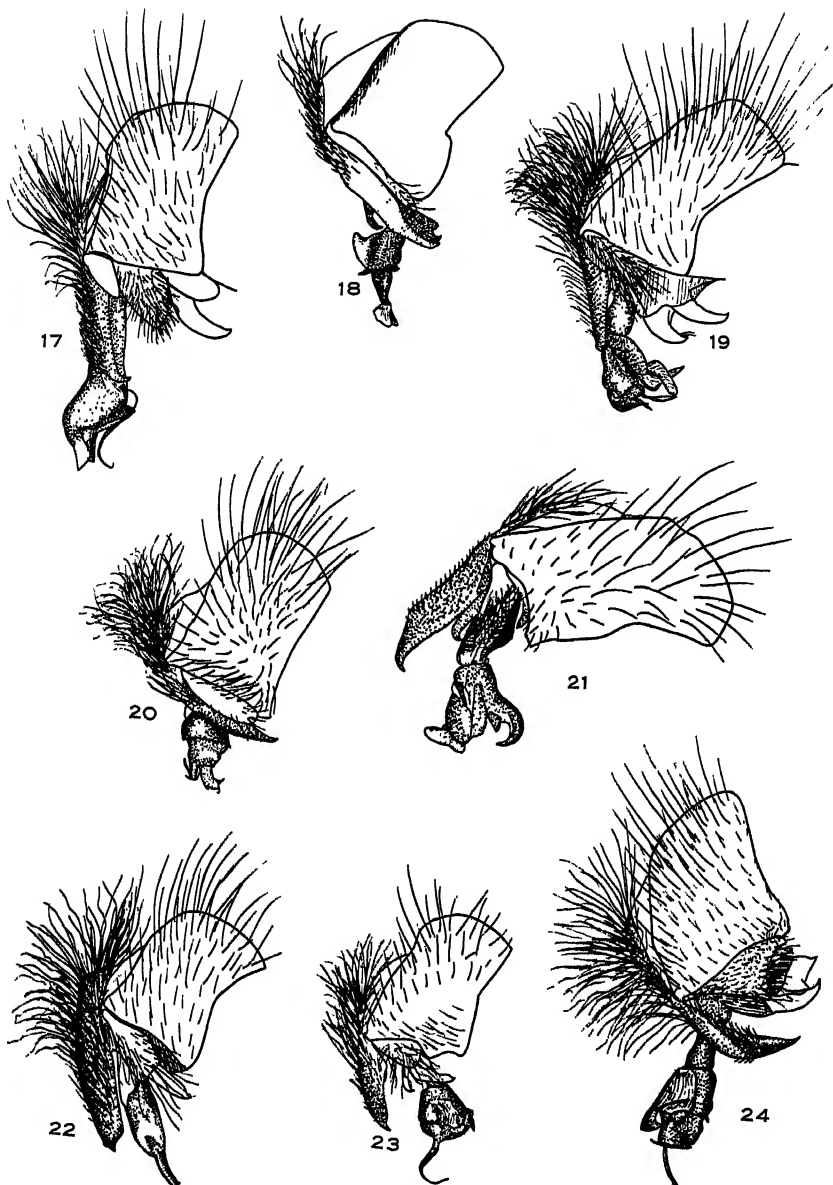


Fig. 17. *Sarcophaga villa*, new species.

Fig. 18. *Sarcophaga alina*, new species.

Fig. 19. *Sarcophaga inzi*, new species.

Fig. 20. *Sarcophaga kisangani*, new species.

Fig. 21. *Poecilometopa notatipennis* Austen.

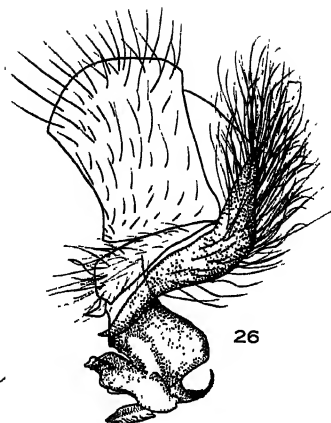
Fig. 22. *Sarcophaga vicaria*, new species.

Fig. 23. *Helicobia munroi*, new species.

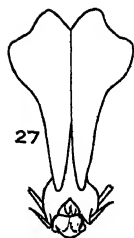
Fig. 24. *Sarcophaga furcadorsalis* Rohdendorf.



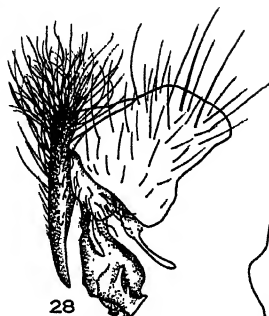
25



26



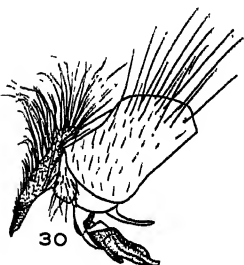
27



28



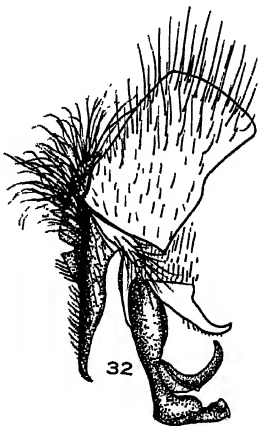
29



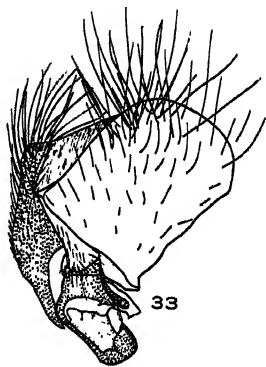
30



31



32



33

Fig. 25. *Sarcophaga falciforceps* Villeneuve.

Fig. 26. *Sarcophaga momba*, new species.

Fig. 27. *Sarcophaga liberia*, new species.

Fig. 28. *Sarcophaga liberia*, new species.

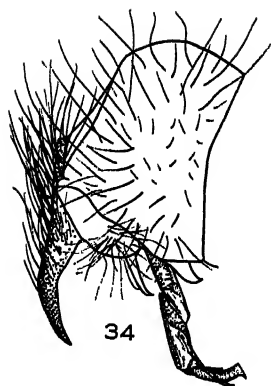
Fig. 29. *Sarcophaga samia*, new species.

Fig. 30. *Sarcophaga samia*, new species.

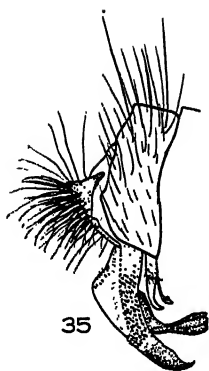
Fig. 31. *Sarcophaga batissa*, new species.

Fig. 32. *Sarcophaga haemorrhoidalis* Fallén.

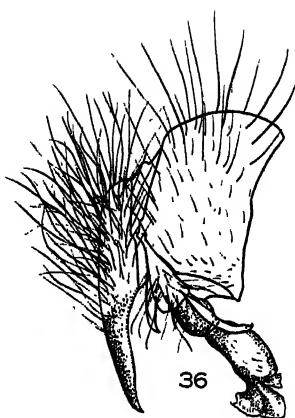
Fig. 33. *Poecilometopa congensis*, new species.



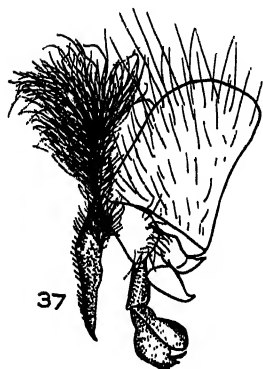
34



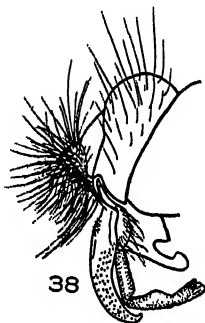
35



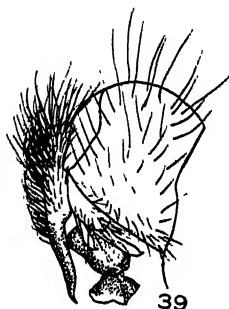
36



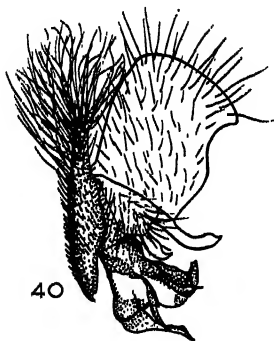
37



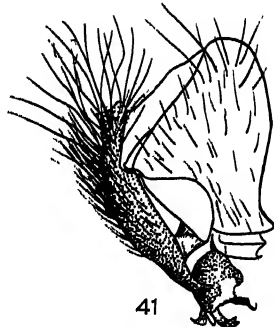
38



39



40



41

Fig. 34. *Sarcophaga chapini*, new species.

Fig. 35. *Sarcophaga fasciventris*, new species.

Fig. 36. *Helicobia selene*, new species.

Fig. 37. *Sarcophaga gnu*, new species.

Fig. 38. *Sarcophaga binodosa*, new species.

Fig. 39. *Helicobia alerta*, new species.

Fig. 40. *Sarcophaga musitalis*, new species.

Fig. 41. *Sarcophaga bulamatadi*, new species.



# AMERICAN MUSEUM NOVITATES

Number 728

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

May 31, 1934

59.82 (85)

## STUDIES OF PERUVIAN BIRDS. XIII

### THE GENERA *DENDREXETASTES*, *CAMPYLORAMPHUS*, AND *DENDROCINCLA*

BY JOHN T. ZIMMER

I am greatly indebted to Dr. Herbert Friedmann of the U. S. National Museum, Washington, and Mr. W. E. C. Todd of the Carnegie Museum, Pittsburgh, for the loan of some of the material used in the following study.

Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

#### *Dendrexetastes rufigula devillei* (Lafresnaye)

*Dend(roc)olaptes Devillei* LAFRESNAYE, 1850, Rev. Mag. Zool., (2) II, p. 102—"Sayaracu" = Sarayacu, Río Ucayali, Perú; Paris Mus.

This form has somewhat broader limits of distribution than heretofore recorded. Among the specimens at hand are three from eastern Ecuador and two from Bolivia; also four from the left bank of the Río Madeira, Brazil, and three from eastern Perú.

This material shows the form to be rather variable without regard to locality. A female from eastern Ecuador and one from the left bank of the Río Madeira are unusually dark and rufescent, and I have seen another example from eastern Ecuador (in the collection of the National Museum of Buenos Aires) similarly colored. The belly is variably suffused with a light ferruginous tint. The pectoral stripes are usually restricted to the chest, rarely suggested on the throat, often without strong dusky margins, and frequently very narrow; when they are most poorly developed, the ground color of the breast is little or not at all darker than the belly, though usually it is a little more deeply colored. The forehead ordinarily is noticeably brighter or lighter than the crown in a broad area, though in one skin from Bolivia there is little distinction. The bases of the neck feathers are broadly whitish with slight prolongations distad along the shafts, not developed enough to form shaft-stripes except in a single female from Lagarto, upper Río Ucayali. In this example there are narrow shaft-streaks that are made somewhat



prominent by the loss of some of the feathers on the hind neck, but they are poorly developed.

On the other hand, three examples from east of the Rio Madeira have well-developed sagittate streaks in a band completely encircling the neck and joining the even more conspicuously streaked area across the breast. Other characters are combined with this feature sufficient to warrant the separation of a distinct form which may be characterized as follows.

***Dendrexetastes rufigula moniliger*, new subspecies**

TYPE from Borba, Rio Madeira (right bank), Brazil. No. 279,759, American Museum of Natural History. Adult male collected February 12, 1930, by the Olalla brothers.

DIAGNOSIS.—Nearest to *D. r. devillei* of eastern Perú, but general color duller, less rufescent; breast darker, more strongly tinged with dark grayish olive and with the pale shaft-stripes broader and more heavily bordered with dusky; bill darker; hind neck and sides of neck prominently streaked with whitish, much less pronouncedly than in *D. r. rufigula* of French Guiana and adjacent parts of northeastern Brazil. Forehead less distinctly paler than the crown.

RANGE.—Right bank of the Rio Madeira, Brazil.

DESCRIPTION OF TYPE.—Top of the head Buffy Brown; forehead narrowly tinged with Sayal Brown; hind neck and sides of neck Olive Brown with sagittate streaks of white, not reaching the tips of the feathers but broadening at base to involve the whole of the webs where there is a light buffy tinge; these streaks only faintly margined with a darker tone; mantle near Saccardo's Umber, unmarked except adjoining the hind neck; lower back Russet x light Auburn; upper tail-coverts a little clearer and "redder." Auriculars like nape; lores slightly grayish; malar region warmer, like forehead; chin and most of throat deep Cinnamon-Buff; lower throat, breast, and sides dark Buffy Brown, each feather with a broad shaft-stripe of white bordered by a dusky line, rounded at tip and not reaching tip of feather; belly Isabella x light Tawny Olive, noticeably lighter than the breast, unmarked; thighs and under tail-coverts similar to belly; under wing-coverts cinnamonaceous. Primaries light Chestnut on outer margins of outer webs, paler on inner webs, especially on inner margins; this rufescent color restricted to the basal third of the outermost primary, increasing in extent on succeeding quills, being nearly obsolete on the seventh (from outside) and quite absent from the eighth; innermost primaries, secondaries, and tertials entirely rufescent, with outer margins browner; upper wing-coverts near the color of the mantle. Tail bright Chestnut-Brown. Bill (in dried skin) pale horn-color, darker on culmen, paler on mandible which has a tinge of yellowish near gonys and is slaty basally; feet dark slate. Wing, 107.5 mm.; tail, 110; exposed culmen, 30; culmen from base, 34.5; tarsus, 24.

REMARKS.—Female similar to the male but smaller. Wing, 101 mm.; tail, 103; exposed culmen, 28; culmen from base, 34; tarsus, 25.12. The single specimen of this sex is paler than the type. A second male is paler and more vinaceous than the type on the scapulars and upper

wing-coverts but these parts are worn and the mantle, which is fresher, is even darker than in the type.

A specimen from Calamá, right bank of the Rio Madeira, was noted by Hellmayr (1910, Novit. Zool., XVII, p. 327), as having well-developed streaks on the hind neck, but he refrained from naming it, having but the single example. The present series shows the constancy of the character.

While *moniliger* is, of course, intermediate between *rufigula* and *devillei*, its characters are quite positive and its range easily defined from the ranges of the other two although the eastern limits of its distribution have yet to be determined. There is no approach, taxonomically, in the birds from the left bank of the Rio Madeira, though a single skin from the Ucayali, eastern Perú, shows some suggestion of the cervical streaking as noted under *devillei*. An additional character suggested by Hellmayr (*loc. cit.*)—the development of obscure whitish shaft-marks on the throat, is poorly shown by the specimens at hand of *moniliger* though observable in some skins of *devillei*. It is evidently individually variable.

There is no indication of the white postocular stripe of the Pará form, *paraensis*, which appears, from descriptions, to be quite distinct. I have no examples of that subspecies.

#### SPECIMENS EXAMINED

*D. r. rufigula*.—BRAZIL: Faro, 1 ♂, 1 ♀; Manaos, 2 ♂, 1 ♀; Igarapé Cacao Pereira (above Manaos), 1 ♀.

*D. r. devillei*.—PERÚ: Sarayacu, 1 ♂, 1 ♀; Lagarto, upper Ucayali, 1 ♀. ECUADOR: mouth of Río Curaray, 3 ♀; BOLIVIA: Todos Santos, 2 ♂. BRAZIL: Rio Madeira (left bank), Rosarinho, 3 ♂, 1 ♀.

*D. r. moniliger*.—BRAZIL: Rio Madeira (right bank), Borba, 1 ♂ (type); Igarapé Auará, 1 ♂; Porto Velho, 1 ♀.

#### *Campylorhamphus trochilrostris thoracicus* (Sclater)

*Xiphorhynchus thoracicus* SCLATER, 1860, P. Z. S. London, XXVIII, p. 277—Babahoyo, western Ecuador; British Mus.

*Campylorhamphus trochilrostris zarumillanus* STOLZMANN, 1926, Ann. Zool. Mus. Polon. Hist. Nat., V, p. 222—Luchugal, northwestern Perú; ♀; Warsaw Mus.

I have seen no Peruvian material, but the characters given by Stolzmann are easily matched in a series of *thoracicus* from western Ecuador (except for the length of the tail which is of little value in this group owing to its extreme variability, due to the wear to which it is subjected). Since Stolzmann had but a single male specimen of *thoracicus* with which to compare his supposed new form, the type of which was a unique female, there is little confidence to be placed in the separation of

*zarumillanus*. There are no other Peruvian records belonging to this form. Records from eastern Perú belong to *napensis*, treated below.

***Campylorhamphus trochilirostris napensis* Chapman**

*Campylorhamphus trochilirostris napensis* CHAPMAN, 1925 (Sept. 28), Amer. Mus. Novitates, No. 187, p. 4—Río Suno, above Avila, eastern Ecuador; ♂; Amer. Mus. Nat. Hist.

A female from Santa Rosa, upper Ucayali, is the third example of this form to be found in Perú. With several additional specimens from eastern Ecuador, the supposed difference in size, which I noted (1930, Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 352) between Peruvian and Ecuadorian examples, is not maintained. A very slight difference in color exists, with the Santa Rosa bird a little more rufescent in tone, but there is much variation in the more northern examples which makes a separation inadvisable. Occasional suggestions of shaft-stripes on the upper wing-coverts, variations in the amount of dusky margining on the gular feathers and in the extent of dorsal and ventral streaking, and slight differences in the color and curvature of the bill are to be found in the Ecuadorian birds and evidently are of an individual nature.

The association of *napensis* with *trochilirostris* is not perfectly clear. In the strong curvature of the bill there is greater resemblance to the *procurvoides* group, but not in the color of the bill nor in the degree of contrast between the colors of the mantle and rump which appear to be of the greatest significance. The blackish outlines of the pale stripes on back and breast are suggestive of *multistriatus* (which I place with *procurvoides*), but the stripes themselves are a little different in character, being broad to the tips, not acutely narrowed as in the *procurvoides* group. I assume the form to be of greater value than the color as a taxonomic character in this case, being less variable. In the shape of the bill there is close approximation between certain specimens of *napensis* and *thoracicus*, though in the latter form the bill normally has the lesser curvature typical of the *trochilirostris* group. In general, *thoracicus* and *napensis* show such similarity that their relationship is evident though their connection with the other members of the group is not so clear. Both are found at relatively low elevations and there is no connectant form which is assuredly conspecific in the intervening region of higher elevation. *C. pusillus pusillus* occupies the Subtropical Zone of northern Ecuador and has some features in common with the *trochilirostris* group, such as a light-colored, lightly curved bill and narrow streaking above and below. It is closer to this group than to *procurv-*

*oides* but is doubtfully conspecific. Specimens from the western coast of Colombia, at Barbacoas and Cocal, apparently belong to the *pusillus* group, but *thoracicus* occurs at Buenavista, above Barbacoas though at a lower elevation than Cocal. The distributional areas of the two groups here appear to overlap, thus arguing against specific union.

Thus the ranges of *thoracicus* and *napensis* seem to be definitely separated by the barrier of the Andes. Similarly both forms are separated from their nearest allies in the *trochilirostris* group though without such apparent barriers. To the northward, *venezuelensis* reaches Alto Bonito, which like Barbacoas is on the western slopes of the Western Andes, while other forms occur on the Amazon and in northern Bolivia, as will be discussed below.

A male and a female from the lowlands north of Cochabamba, Bolivia, are definitely distinct from *lafresnayanus* of Matto Grosso, Brazil (described from Chiquitos, eastern Bolivia), and even more distinct from *napensis*. It may be known as follows.

#### ***Campyloramphus trochilirostris devius*, new subspecies**

TYPE from Todos Santos, Province of Cochabamba, Bolivia; altitude 1300 feet. No. 137,410, American Museum of Natural History. Adult male collected July 2, 1915, by Leo E. Miller and Howarth Boyle.

DIAGNOSIS.—Nearest to *C. t. lafresnayanus* but with a much shorter bill, with the general coloration decidedly darker, and with a strong hue of buff on the lower throat.

RANGE.—Humid Tropical Zone of northern Bolivia.

DESCRIPTION OF TYPE.—Top of head dark Argus Brown, a little sootier at the tips of the feathers, and with obovate, light buffy shaft-stripes reaching relatively near to the bases of the feathers; hind neck and sides of neck lighter brown, with shaft-stripes broader but less well defined; mantle a trifle lighter than Brussels Brown, with poorly developed shaft-lines of buff, obsolete on the lower portion; rump light Auburn, not abruptly defined from the mantle; upper tail-coverts a little deeper. Lores whitish, with dusky tips; auriculars with buffy shaft-stripes and dark brown margins; malar region with blackish brown margins and broad, buff shaft-stripes; chin buffy white, with rather strong, blackish, lateral margins; throat strongly buff, with dusky margins passing narrowly around the tips of the lower feathers where, however, they are browner and less dusky; breast light Brussels Brown, with moderately broad, buffy shaft-stripes; sides darker, with shaft-stripes narrower and less well defined; belly a little paler and duller, with shaft-stripes progressively less well defined, becoming obsolete on the lower portion; flanks light Argus Brown with a tinge of Auburn; under tail-coverts light Auburn, with faint, pale shaft-lines. Remiges dark Sanford's Brown, clearest on secondaries and tertiaries; primaries with dusky tips, not sharply defined and occupying no more than the distal third of the outermost one; upper wing-coverts rufous, with a slight tinge of the color of the mantle on their tips and with ill-defined, pale shaft-streaks; lesser coverts not pronouncedly brighter than

the remainder; under wing-coverts deep Ochraceous-Tawny; tail Auburn (x light Chestnut); bill (in dried skin), light Sayal Brown, slightly dusky at base and tip; feet dull, light brown. Bill falcate, but less curved than in the *procurvoides* group. Wing, 102.5 mm.; tail, 92; exposed culmen, 59.5; culmen from base, 62; culmen from base, measured along curve, 67.5; tarsus, 23.

REMARKS.—A female from Mission San Antonio, Río Chimoré, is even darker than the type and is slightly more strongly streaked with the streaks extending a little farther posteriorly. The tip of the maxilla is broken off but the mandible agrees in length with that of the type. The wing is longer (108 mm.) but the tail is shorter (80.5 mm.), presumably due to abrasion; tarsus, 22 mm.

A series of seven specimens of *lafresnayanus* (including the type of "*rufo-dorsalis*") from Matto Grosso, Brazil, and from Paraguay have the culmen from base measuring 70–82 mm.; along the curve, 75.25–86. Measurements of other specimens from Matto Grosso and Paraguay and of the type of *lafresnayanus* (Hellmayr, 1925, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, part 4, p. 341, footnote *a*) show the same large size. I have no examples from Argentina, which have even longer bills and which have been separated by Laubmann under the name *hellmayri*.

*C. t. lafresnayanus* is so obviously conspecific with *trochilirostris* that no comment is necessary. The latter form intergrades with *major* somewhere in the neighborhood of Pernambuco where the resident form appears to be intermediate. On the Tocantins and westward to the right bank of the Tapajoz, there appears to be no representative of the *trochilirostris* group. The region is occupied by *multistriatus* which shows closer affinities with the *procurvoides* group, under which it will be further discussed. To the westward of the Tapajoz and on the north bank of the Amazon, however, there is an interesting new form which shows much affinity to the present series with which I believe it may be specifically united. It occurs at the same localities as representatives of the *procurvoides* group which it resembles in various respects, but probably occupies a different ecological niche as will be discussed below. It may be known as follows.

#### ***Campyloramphus trochilirostris snethlageae*, new subspecies**

TYPE from Serra de Parintins, Villa Bella Imperatriz, Rio Amazonas (south bank), Brazil. No. 278,745, American Museum of Natural History. Adult female collected November 15, 1930, by the Olalla brothers.

DIAGNOSIS.—Nearest to *C. t. devius* of northern Bolivia but even darker and duller, with a strong Auburn tinge on the under parts and a cinnamon brown back, moderately streaked; top of head more narrowly streaked; throat white with brown margins but without a buff tinge. Compared with *C. p. procurvoides* of French Guiana

and Faro and *C. p. brasiliensis* of Villa Bella Imperatriz, it may be known by its longer, paler, and less strongly curved bill; by the lack of pronounced contrast between the colors of mantle and rump; by the streaks on chest and hind neck being broad distally, not sagittate; by the clearer rufous color of the wings externally; by the more cinnamonaceous, less ochraceous color of the under wing-coverts; and by the general auburn tint of the breast and lower under parts.

RANGE.—Both banks of the lower Amazon, at Villa Bella Imperatriz, on the south bank, and at Faro (and apparently also at Monte Alegre) on the north bank.

DESCRIPTION OF TYPE.—Top of head Bister, with broad, rather rectilinear Cinnamon-Buff shaft-stripes, narrowing about the middle of the feathers; hind neck a little paler and with stripes slightly broader and less well defined; mantle warm Cinnamon-Brown, with an Auburn tinge, and with pale buffy shaft-streaks tending to enlarge near the tips of the feathers, broadest near hind neck and hairlike on lower portion; rump only faintly more rufous than the back; upper tail-coverts a little brighter, dark Hazel x light Auburn on the longest feathers. Lores whitish; malar region and auriculars whitish with narrow dusky lateral margins; chin white, with traces of narrow dark margins; throat similar with broader lateral margins; breast and sides warm Brussels Brown with a russet tinge and with broad whitish shaft-stripes, broadly rounded at ends but usually not reaching the tips of the feathers; belly more strongly tinged with russet medially and with stripes becoming obsolete posteriorly; flanks and under tail-coverts between Snuff Brown and Saccardo's Umber. Outer surface of wings light Chestnut (x Auburn); tips of primaries shaded with dusky, about to middle of outer primary; secondaries and tertials clear; under wing-coverts Tawny (x Ochraceous Tawny); tail Bay x Chestnut. Bill (in dried skin) dark Hazel; feet dull slaty. Wing, 104.25 mm.; tail, 91; exposed culmen, 58.5; culmen from base, 61; culmen from base, measured along curve, 67; tarsus, 21.

REMARKS.—Females very like the males but with shorter wings (91.5–97 mm.) and tail (78–88 mm.); bill and tarsus as in the males.

This interesting bird is not entirely unrecorded. In 1913 (Jour. für Orn., LXI, p. 527), Dr. Emilia Snethlage gave some critical notes on a form of *Campyloramphus*, different from *procurvoides* and apparently of the *trochilirostris* group which she found at Faro and Monte Alegre in the "varzea" or inundated forest where *procurvoides* was not found. From the description there is no doubt that Dr. Snethlage had specimens of the present new form to which, however, she did not give a name. A specimen at hand from Faro agrees with the skins from the south bank of the Amazon. A positive association of this bird with the "varzea" would explain its occurrence on both sides of the Amazon, for the river would not be so effective a barrier for species of this habitat as for those of the drier woods. Thus true *procurvoides* which inhabits the drier areas (according to Dr. Snethlage) is restricted to the north bank of the Amazon while on the south bank a separable form is found, as will be discussed on a later page under that species.

Except in the case of *snethlageae* and one other form, treated below,

there is no true "varzea" in the ranges of the different subspecies of *trochilirostris*. Possibly *snethlageae* and the next discussed form are later arrivals in the lower Amazonian region than *procurvoides* and found the dry-forest "niche" preëmpted by the other species (which seems to be more abundant in the region, judging by proportions of collections). It might thus have been forced to accommodate itself to the "varzea" conditions in which it now exists.

No specimens at hand from the immediate right bank of the Madeira belong to the present group, but three examples from the left bank are conspecific though they are so distinct in subspecific characters that they deserve separation as follows.

***Campyloramphus trochilirostris notabilis*, new subspecies**

TYPE from Lago Miguel, Rosarinho, Rio Madeira (left bank), Brazil. No. 282-312, American Museum of Natural History. Adult female collected June 14, 1931, by the Olalla brothers.

DIAGNOSIS.—Similar to *C. t. snethlageae* but with the general color paler brown and with the dorsal and ventral stripes purer white and much broader.

RANGE.—Left bank of lower Rio Madeira, Brazil.

DESCRIPTION OF TYPE.—Top of head blackish, with broad whitish or light buffy shaft-stripes narrowing toward the bases of the feathers; hind neck lighter brown on narrow lateral and terminal margins, leaving broad, whitish shaft-stripes, rounded toward the tips of the feathers; mantle near Brussels Brown, with broad, elongate-ovate spots of whitish, broader next to the neck, narrower on posterior feathers; rump with a testaceous wash; upper tail-coverts brighter, light reddish Auburn. Lores white; sides of head and neck whitish with narrow lateral margins of dusky brown; breast and sides with narrow margins of Brussels Brown and very broad whitish shaft-stripes nearly or quite reaching to the tips of the feathers; upper belly pale buffy brown on margins, bordering broad whitish or buffy shaft-stripes which become obsolete on lower belly which is light brownish buff; under tail-coverts light grayish brown with whitish shaft-lines. Wings as in *snethlageae*, tail light Chestnut x Auburn. Bill (in dried skin) dark Hazel, slightly grayish at base and tip, relatively lightly curved (compared to *procurvoides*); feet slaty. Wing, 96 mm.; (tail in molt); exposed culmen, 54; culmen from base, 58; culmen from base, measured along curve, 63; tarsus, 21.5.

REMARKS.—Male apparently like the female. A badly worn example of this sex from Lago Sampaio is somewhat darker than the type and has the streaks on the mantle noticeably narrower though it is easily separable from *snethlageae* in this and other diagnostic characters. A third example without given sex, also from Lago Sampaio, is darker than the type but has the streaks of the mantle (and other regions) equally broad. The wings of these two examples measure 95 and 94 mm.; tails, 87 and 82; culmens from base, 61 and 56; culmens from base along curve, 67 and 62.5; tarsi, 21 in both.

There is a curious difference in the texture of the body plumage of these birds and members of the *procurvoides* group, especially noticeable on the uropygium though not confined to that region. The feathers are of loose texture in both groups, having no barbicels, but they seem even less compact in *snethlageae* and *notabilis* than in the *procurvoides* group. The only significant difference under magnification appears to be the somewhat longer barbules of the *procurvoides* feathers, permitting a broader overlapping. Other members of the *trochilirostris* group exhibit the difference to a less pronounced degree. Probably the reduced contrast in the colors of the rump and back in the *procurvoides* group is due partly to this characteristic of texture.

A character of some value in the separation of the *trochilirostris* and *procurvoides* groups may be found in the length of the tarsi. In the localities where forms of both groups occur together, the examples of the *trochilirostris* group have slightly longer legs, from 21 to 22 mm.; those of the other group, from 19 to 20. This tendency is reflected in other regions where the *trochilirostris* forms may increase this measurement to 23 mm., while the *procurvoides* forms may go down to 18. Taken in conjunction with the other characters it is of considerable interest, though its absolute constancy must be substantiated by greater series. It is not correlated with a corresponding increase in the other measurements except a longer average chord of the culmen due to the lesser curvature of that member; measured along the curve, the bills in both groups are relatively equal in length.

*C. t. venezuelensis* apparently belongs to the *trochilirostris* group with almost as much deviation from the normal pattern as is shown by *napensis* and *thoracicus*. Its full range still remains to be worked out. Undoubtedly it extends across northern Venezuela to the Santa Marta region of Colombia, ascends the Magdalena and Cauca valleys at low elevations and reaches the western slopes of the western Andes at Alto Bonito. In Venezuela, the range extends southward to the Orinoco at Caicara, but the matter of its further extension southward is in need of further study.

Pelzeln (1868, 'Orn. Bras.,' I, p. 44), records examples of "*trochilirostris*" from Marabitanas, Barra do Rio Negro (= Manaos), and Rio Amajau (or Anajahú), which Hellmayr (1910, Novit. Zool., XVII, p. 331) refers tentatively to *venezuelensis* though the skins from the first two localities were not to be found for reexamination, and the bird from Rio Anajahú was not typical. I strongly suspect that the Rio Anajahú skin belongs to *snethlageae*; Manaos examples may also be referable to this



form, though it is equally possible that they really belong to *procurvoides* and the Marabitanas skins to a separable subspecies of that group which is discussed below. Since the specimens from these two localities are lost, their exact allocation must remain doubtful.

A small series of birds from eastern Panamá is unsatisfactory for the criticism of *C. t. brevipennis*, described from the Canal Zone. While the average measurements of wing and tail are below the average of Colombian and Venezuelan examples, the overlap is greater than the differences of extremes unless *brevipennis* is restricted to the Canal Zone and other localities to the eastward in Panamá are included in the range of *venezuelensis*. A male from Cape Garachiné, for example, has a wing of 100.5 mm., and a tail of 90, while one from Cotiza, Caracas, Venezuela, shows 97 and 86 respectively. Larger series from eastern Panamá are needed to determine the limits of range if two forms are to be recognized in this part of the country.

Since much comparative study was required in the *procurvoides* group, the results of the examination may be included here. In the first place, it has become apparent that the birds of this group from south of the Amazon are separable from typical *procurvoides* of the region from French Guiana southward to the north bank of the Amazon at Faro and Obidos. Examples from east of the Rio Tapajoz, the Xingú, and the Tocantins belong to *C. p. multostriatus* which is well characterized by the warm but dark brown back, the more blackish top of the head, the stronger streaking above and below with the pale streaks prominently margined with blackish, and by the clearer white throat and the darker reddish bill. It is suggestive of *C. trochilirostris thoracicus* in various respects but has the bill of the *procurvoides* group to which it is unquestionably allied by way of the form living west of the Tapajoz which presents some of the characters of both *procurvoides* and *multostriatus*. This form may be known as follows.

#### **Campyloramphus procurvoides probatus, new subspecies**

TYPE from Igarapé Auará (near Borba), Rio Madeira (right bank), Brazil, No. 279,773, American Museum of Natural History. Adult female collected March 11, 1930, by the Olalla brothers.

DIAGNOSIS.—Nearest to *C. p. multostriatus* from lower Amazonia, east of the Rio Tapajoz, but top of head less blackish; pale stripes on head and back usually narrower and more buffy in tone and not so prominently (usually not at all) outlined with dusky; general color of mantle duller brown; chin and throat duller with dark brown lateral margins on the feathers more pronounced; ventral stripes usually narrower, less strongly or not at all margined with dusky; belly less prominently striped.

Compared with typical *procurvoides* the color of the mantle is warmer with the streaks somewhat more developed, the bill is rather lighter reddish, the throat-feathers are margined laterally with brown giving a streaked appearance to the region (in *procurvoides* they pass around the tips of the feathers with a resultant squamate effect); the general color of the under parts varies from olive brown as in *procurvoides* to a much warmer tone, with the pale stripes sometimes much as in *procurvoides*, sometimes much stronger and with a little development of the dusky outlines best marked in *multostriatus*.

RANGE.—South bank of the Amazon, in Brazil, from the left bank of the Tapajoz westward at least as far as the Rio Madeira.

DESCRIPTION OF TYPE.—Top of head dark Chaetura Drab with moderately broad shaft-stripes of light buff; not reaching the tips of the feathers; hind neck like crown; sides of neck browner; mantle Brussels Brown x Argus Brown, anteriorly with rather narrow buffy shaft-streaks, obsolete on posterior portion; rump light Chestnut x Auburn in noticeable contrast to mantle; upper tail-coverts faintly darker. Lores dull whitish; auriculars with narrow buffy or whitish shaft-streaks and dark brown margins; chin whitish; throat whitish with dusky brown lateral margins not passing around the tips of the feathers except on lowermost portion; breast Dresden Brown x Raw Umber with relatively broad sagittate shaft-stripes of buffy white, not quite reaching tips of feathers and slightly outlined with dusky, at least on upper portion; sides of breast with streaks somewhat narrower; belly paler, approaching dark Isabella Color, with the shaft-stripes duller than on breast but still apparent, at least on mid-line; flanks darker and browner than belly, obsoletely streaked with paler; under tail-coverts darker than belly, near Saccardo's Umber, with whitish shaft-lines. Remiges bright Auburn with the inner webs suffused with dusky at least terminally, reaching nearly to the base of the outermost primary, but obsolete on the tertials; inner margins again brighter; outer margins tinged with brownish; greater upper wing-coverts with a stronger pale brownish tinge; median series a little clearer; lesser series distinctly brighter rufous of a testaceous hue; under wing-coverts light Ochraceous-Tawny; tail Chestnut x Bay. Bill (in dried skin) light Bay; feet dull slate. Wing, 95 mm.; tail, 75 (worn); exposed culmen, 59; culmen from base, 61; culmen from base along curve, 68; tarsus, 18.25.

REMARKS.—Males like the females but averaging slightly larger (wing, 95–99 mm. as against 93–96 in the females).

The variations of this subspecies have been mentioned above in passing. A male from Limôãl, Rio Tapajoz, shows the nearest approach to *multostriatus* in the development of the dusky outlines surrounding the pale stripes of the anterior mantle and the breast, but it is even lighter colored on the mantle than the type of the present form. Other examples have the dusky outlines less apparent than in the type, though most of them show some traces. A single female from Teffé is of uncertain position and resembles *trochilirostris snethlageae* in some respects (cinnamonous under wing-coverts, an auburn tinge on the flanks and mid-belly, relatively lightly falcate bill of not deeply reddish color, long tarsus (21 mm.), and little contrast between the colors of lesser and greater

wing-coverts. However, the pale ventral streaks are sagittate (though not outlined with dusky) and there is considerable contrast between mantle and rump, agreeing best with the *procurvoides* group, especially with the birds from the upper Rio Negro discussed below. A series from this region will be necessary to determine the status of the resident form.

Birds from the upper Rio Negro and the upper Orinoco are also notably distinct from typical *procurvoides* but are not to be confused with *probatus*. The description follows.

***Campyloramphus procurvoides sanus*, new subspecies**

TYPE from "Campamento del Medio," Mt. Duida, Venezuela; altitude 350 ft. No. 274,270, American Museum of Natural History. Adult male collected January 25, 1929, by the Olalla brothers.

DIAGNOSIS.—Nearest to *C. p. procurvoides* but much more warmly colored and distinctly smaller, especially the bill which averages more strongly falcate; throat less buffy, more whitish, and more streaked, not squamate.

Compared with *probatus*, the upper parts are very similar in some cases, but the under parts are distinctly warmer in tone and without any of the dusky outlines around the pale streaks; the throat is a little more squamate than in *probatus* though not so strongly as in *procurvoides*, and the bill shows the same difference from both forms in shape and length.

RANGE.—Upper Rio Negro, Brazil, to upper Orinoco, Venezuela, extending westward to the foot of the Andes in Colombia and eastward to western British Guiana.

DESCRIPTION OF TYPE.—Top of head near Sepia, with narrow buffy shaft-lines from middle of feathers to near the tips which are a little sooty; hind neck lighter brown, with shaft-streaks slightly broader and paler buffy; mantle dark Brussels Brown, anteriorly with narrow shaft-streaks, less prominent than those of hind neck and obsolete on remainder of back; rump and upper tail-coverts light Chestnut, rather sharply differentiated from mantle. Lores whitish; auriculars and sides of neck like crown but with shaft-streaks more whitish; chin whitish with a brownish tinge on the margins of the feathers; throat-feathers with lateral margins dark brown tending to enclose the central spots of whitish which are narrowed toward the tips; breast and sides near Brussels Brown with relatively narrow sagittate shaft-spots of whitish, not reaching tips of feathers and much reduced in size on sides and upper belly, nearly obsolete on lower belly and flanks which are light Dresden Brown; under tail-coverts like lower belly. Remiges Chestnut x Auburn, clearest on tertials, but with a brownish wash on outer margins of primaries and secondaries; tip of primaries dusky (up to distal half of outermost), more diffuse on the secondaries; upper wing-coverts rufous with a brownish wash on greater and median series; under wing-coverts Ochraceous-Tawny. Bill (in dried skin) Bay, dusky at base of maxilla; feet dusky slate. Wing, 95 mm.; tail, 80; exposed culmen, 50; culmen from base, 53; culmen from base along curve, 60; tarsus, 19.

REMARKS.—Females like the males but averaging a little smaller. Wing, 89–94; tail, 74–77.5; culmen from base, 51–57; culmen from base along curve, 60–64; tarsus, 18–20. Males average: wing, 89–99 mm.;

tail, 71-88; culmen from base, 52-57; culmen from base along curve, 58-66; tarsus, 18-20.

Two females from the base of the eastern Andes of Colombia, Villavicencio and La Morelia, are close to the present form in coloration and seem to belong here. They are slightly larger than the rest of the females but within the measurements of the males, except that the Villavicencio bird has unusually long tarsi (21 mm.), in this respect like the *trochilirostris* group. Unfortunately both birds have broken bills, which prevent an accurate study of this feature. More material from this region is desirable.

The single skin from western British Guiana is quite typical of *sanus* and distinct from *procurvoides*. There appear to be no records of any form of this group from Dutch Guiana and the connection between *sanus* and *procurvoides* has yet to be established either by that route or by way of the Rio Negro.

*Campylorhampus procurvoides brasiliensis* Stolzmann 1926 [(December 31), Ann. Zool. Mus. Polon. Hist. Nat., V (4), p. 221], described from a specimen without sex or locality other than "Brésil," appears, from its description, to be *C. falcularius*, probably based on a "Rio" skin.

#### SPECIMENS EXAMINED

*C. t. trochilirostris*.—BRAZIL: Bahia, Santa Ritta, 2 ♂, 1 ♀.

*C. t. lafresnayanus*.—BRAZIL: Matto Grosso, Palmyras, Rio Taquary, 1 (?); Corumba, 1 (?); Urucúm, 1 ♀; Descalvados, 2 ♂. PARAGUAY: Fort Wheeler, 2 ♂.

*C. t. sneithlagae*.—BRAZIL: Villa Bella Imperatriz, Serra de Parintins, 1 ♂ (type), 1 ♀; mouth of Rio Andirá, 1 ♂, 1 ♀; Rio Jamundá, Faro, 1 ♂.

*C. t. notabilis*.—BRAZIL: Rio Madeira (left bank), Rosarinho, 1 ♂, 1 ♀ (type), 1 (?).

*C. t. devius*.—BOLIVIA: Todos Santos, 1 ♂ (type); Río Chimoré, Mission San Antonio, 1 ♀.

*C. t. napensis*.—ECUADOR: Río Suno, above Avila, 1 ♂ (type), 1 ♀; lower Río Suno, 1 ♀; below San José de Sumaco, 1 ♀; mouth of Río Curaray, 1 ♂. PERÚ: Santa Rosa, Río Ucayali, 1 ♀<sup>1</sup>; Puerto Bermúdez, 1 ♂<sup>1</sup>; Vista Alegre, Río Chinchao, 1 ♀.<sup>1</sup>

*C. t. thoracicus*.—ECUADOR: Esmeraldas, 2 ♂, 1 ♀; Chone, Manavi, 1 ♂ (?); Naranjo, 2 ♂, 1 ♀; Chimbo, 1 ♂; Pambilar, 1 ♂<sup>1</sup>; Puente de Chimbo, 1 ♂<sup>1</sup>, 1 ♀<sup>1</sup>; Santa Rosa, 3 ♀; Alamor, 2 ♂; Bucay, 1 ♀; El Destino, Manavi, 1 ♂. COLOMBIA: Buenavista, Narino, 1 (?).

*C. t. venezuelensis*.—VENEZUELA: Las Trincheras, 1 ♂, 1 ♀; Cotiza, 1 ♂, 1 ♀; Cumanacoa, 1 ♀; Caicara, 1 ♂; La Trinidad, 1 ♀; Mt. Turumiquiri, 1 ♂. COLOMBIA: Alto Bonito, 1 ♂; near Honda, 1 ♀; Cabrera, Tolima, 1 (?).

*C. t. brevipennis*.—PANAMÁ: (Lion Hill), 1 ♂, 1 ♀.

<sup>1</sup>Specimens in Field Museum of Natural History, Chicago.

*C. t. venezuelensis* x *brevipennis*.—PANAMÁ: Cape Garachiné, 1 ♂; Tacarcuna 1 ♂, 1 ♀; Boca de Cupa, 1 ♂; El Real, Río Tuyra, 1 ♂.

*C. p. procurvoides*.—FRENCH GUIANA: Tamanoir, 1 ♂. Brazil: Faro, 2 ♂, 2 ♀.

*C. p. sanus*.—VENEZUELA: Mt. Duida, "Campamento del Medio," 1 ♂ (type); "Playa del Río Base," 1 ♂, 1 ♀; "Pte del Cerro," 1 ♂; Río Orinoco, Esmeralda, 1 ♀; mouth of Río Ocamo, 1 ♂; Río Cassiquiare, Solano, 1 ♀: opposite El Merey, 1 ♀. BRAZIL: Río Negro, Tatú, 1 ♂, 1 ♀; Mt. Curucuryari, 2 ♂; Río Uaupés, Tahuapunto, 1 ♂. BRITISH GUIANA: Tumatumari, 1 ♀. COLOMBIA: Villavicencio, 1 ♀; La Morelia, 1 ♀.

*C. p. probatus*.—BRAZIL: Río Madeira, Igarapé Auará, 2 ♂, 3 ♀ (including type); Río Amazonas, Villa Bella Imperatriz, 3 ♂, 2 ♀, 1 (?); Río Tapajoz (left bank), Limoã, 2 ♂; Igarapé Brabo, 1 ♂; Igarapé Amorin, 1 ♀; Boim, 1 ♀.

*C. p. subspecies?*—BRAZIL: Teffé, 1 ♀.

*C. pusillus pusillus*.—COLOMBIA: "Bogotá," 1 (?); Fusugasuga, 1 (?); east of Palmira, 1 ♂, 1 ♀; Salencio, 1 ♂; San Antonio, Cauca, 1 ♂; (no locality = Antioquia ?), 1 (? (type of *C. "chapmani"*); Barbacoas, 1 ♂<sup>1</sup>; Cocal, 1 ♂.<sup>1</sup> ECUADOR: Baeza, 1 ♂; lower Sumaco, 4 ♂, 1 ♀.

*C. pusillus olivaceus*.—PANAMÁ: Chitrá, 1 ♀ (type); Río Calovevora, 1 ♀ (?).

*C. pusillus borealis*.—COSTA RICA: 8 ♂, 1 ♀.

### ***Dendrocicla merula bartletti* Chubb**

*Dendrocicla bartletti* CHUBB, 1918, Bull. Brit. Orn. Club, XXXIX, p. 5—Chamicuros, Perú; Brit. Mus.

I am unable to unite this form with the Guianan *merula* which, judging by the material at hand, is quite readily distinguished by a number of characters. The Peruvian birds are distinctly lighter and brighter in general coloration; the chin-spot is more purely whitish and is broader and less sharply defined from the throat; the outer webs of the outer two primaries are dusky, not rufescent, and the terminal portions of the primaries and outer secondaries are more sooty, dark for a greater distance from the tips (25–35 mm. on fourth and fifth outer primaries) and more sharply defined from the rufescent basal areas; the bill is longer; the lores are more whitish in most cases; the smaller, lesser upper wing-coverts are duller and less deeply rufescent; and the tail averages lighter rufous.

There is no representative of this species known from Perú north of the Amazon nor from Ecuador, but *bartletti* extends along the south bank of the Amazon eastward as far as the left bank of the Río Madeira. Again there are no records from the north bank of the Amazon, west of the Río Negro, but farther up this latter stream, along the Cassiquiare in Venezuela, in the vicinity of Mt. Duida, and on the upper course of the Orinoco and its affluents, the birds are indistinguishable, for the most

<sup>1</sup>Not typical.

part, from the Peruvian specimens. There is an occasional tendency toward true *merula*, but the birds agree best with *bartletti*.

Specimens from east of the Rio Madeira and west of the Tapajoz are much more olivaceous in tone than those from any other region, but have the sooty wing-tips and some other characters of *bartletti*. They represent an undescribed subspecies which will be discussed below. In eastern Bolivia *remota* is found, a form which is very close to *bartletti* but differs by somewhat paler, though not less rufescent, coloration. East of the Tapajoz and extending probably to the left bank of the Tocantins, though its eastward limit is in doubt, exists *castanoptera*, exceedingly like *bartletti* in general coloration but recognizable by the paler wing-tips, on which the rufous basal coloration encroaches for a greater distance, and by the rufous outer margins of the outer two primaries, following the style of *merula* though the general plumage is much brighter and more rufescent. In this form, also, the pale chin-spot is small as in *merula* though whiter and less sharply defined. The bill is largely black or with only a narrow, pale line along the gonys. On the east bank of the Tocantins another new form occurs which is deeper and clearer rufous than *castanoptera*, with the upper tail-coverts hardly brighter than the back, the chin-spot larger and more sharply defined, and the mandible paler, but the tip and outer margins of the primaries are as in *castanoptera* and *merula*.

It is possible that *merula* needs to be subdivided. A single skin from French Guiana and one from Faro, Brazil, agree well with each other. On the other hand, three specimens from British Guiana, though their general coloration is that of the other two skins, have the chin-patch much more restricted. This apparent difference may be due to the preparation of the specimens but I am not certain that it may be entirely so dismissed, for there is a certain amount of variation exhibited by the other subspecies. A good series might determine the point. I have seen no examples from Manaos but I judge this locality to be within the range of *merula* rather than of *bartletti*.

At present, as mentioned above, there is a hiatus in the range of *bartletti* and it is impossible to say whether it will be bridged (in future discoveries) by way of eastern Ecuador or the lower Rio Negro, Brazil.

Records of this species from Perú, assignable to *bartletti*, are from Chamicuros, Shanusi near Yurimaguas, and Sarayacu to which others are added in the subjoined list of material examined.

The new forms may be characterized as follows.

***Dendrocincla merula olivascens*, new subspecies**

TYPE from Villa Bella Imperatriz, Lago Andirá, Rio Amazonas (south bank), Brazil. No. 277,998, American Museum of Natural History. Adult male collected September 10, 1930, by the Olalla brothers.

DIAGNOSIS.—Nearest to *D. m. bartletti* of northeastern Perú but decidedly more olivaceous in general coloration.

RANGE.—Area between the Rio Madeira and the Rio Tapajoz, Brazil, not crossing either stream.

DESCRIPTION OF TYPE.—Top of head and mantle Brussels Brown x Raw Umber; lower back slightly brighter but upper tail-coverts rather sharply defined, Sanford's Brown x Burnt Sienna. Loes only slightly duller and grayer than rest of the sides of the head which are darker and more olivaceous brown than the crown; chin narrowly whitish in a small patch somewhat abruptly defined from the throat which, however, has a few whitish margins on the feathers of the upper portion; throat light Raw Umber; breast and sides Raw Umber x Medal Bronze; belly a little paler, Raw Umber x Dresden Brown; under tail-coverts Sanford's Brown x Auburn. Wings light chestnut on most of exposed outer surface but outer webs of two outer primaries dusky, not rufescent; tips of primaries and outer secondaries on inner webs sooty fuscous (reaching 30 mm. from tips on fourth and fifth outer primaries) relatively clearly defined from the rufous median and basal areas; under wing-coverts tawny ochraceous-orange. Tail Chestnut x Bay. Bill (in dried skin) largely blackish but lower part of mandible pale though not sharply defined; feet slaty. Wing 100 mm.; tail 80; exposed culmen 23.12; culmen from base 27; tarsus 24.

REMARKS.—The females are possibly slightly smaller than the males in average measurements but in coloration are inseparable. One female from the type locality has the bill colored as described for the type, but the other specimens of both sexes have the mandible yellowish except for a narrow space along the tomlia. The two birds with darker bills are not immature (though a black bill is a character of immaturity in this group) and I judge this variability here shows an approach toward *castanoptera* in which the bill is usually fully black or with a narrow, rather sharply defined yellowish line along the gonys.

One specimen is slightly more rufescent than the type and another is even more strongly olivaceous, but, in general, the series at hand is very uniform.

***Dendrocincla merula badia*, new subspecies**

TYPE from Pedral, Rio Tocantins (right bank), Brazil. No. 430,982, American Museum of Natural History. Adult male collected December 8, 1931, by Alfonso M. Olalla.

DIAGNOSIS.—Nearest to *D. m. castanoptera* but upper surface decidedly clearer rufous and more inclined to chestnut; upper tail-coverts only a little brighter than the back and not sharply defined in color; under parts distinctly warmer; chin-spot more sharply defined, larger, whiter on upper portion but with an ochraceous tinge on the juncture of the chin and throat; mandible paler.

RANGE.—Region of the east bank of the Rio Tocantins and western Pará, Brazil.

DESCRIPTION OF TYPE.—Top of head and mantle light Auburn x Chestnut, becoming a little deeper on lower back and approaching Bay on the upper tail-coverts. Lores slightly duller and grayer than crown; rest of sides of the head darker and browner; chin dull whitish, with the lower portion or the adjacent part of the upper throat tinged with cinnamon-buff, the whole forming a rather sharply defined patch; lower throat and breast warm, dark Brussels Brown; belly warmer, becoming distinctly suffused with Auburn x Chestnut on lower portion and on flanks; under tail-coverts near Bay; under wing-coverts Auburn x Sanford's Brown. Exposed outer surface of wings Bay, including outer webs of two outer primaries to near tips; inner webs of remiges strongly rufescent (with a vinaceous tone) from their bases to near the tips (about 16 mm. from tips on fourth and fifth outer primaries) where the color becomes gradually obsolete; tips of primaries and outer secondaries light fuscous, not sharply defined. Tail Bay. Maxilla blackish (in dried skin); mandible dull yellowish except at extreme base; feet slaty. Wing, 100 mm.; tail, 77; exposed culmen, 21.5; culmen from base, 25; tarsus, 24.

REMARKS.—Female generally like the male but smaller. With a single specimen of each sex at hand, the exact range of individual variation can not be fixed. The present female is slightly less warm in tone below but is even nearer Chestnut above. The cinnamon-buffy tinge of the gular region appears to be more definitely on the throat than on the lower part of the chin. Both skins, however, are much "redder" than any example of any of the other forms.

A young male from Igarapé-Assú, Pará, is noted by Hellmayr (1905, Novit. Zool., XII, p. 281) which he compares with the type of *merula* from Cayenne and with a topotype of *castanoptera* from near Santarem, all three of which were found to be very similar. Later (1925, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, part 4, p. 371) he recognized *castanoptera* as distinct and referred the Igarapé-Assú specimen to it together with others from Peixe-Boi and Rio Guamá, all of which must be referable to the new form, *badia*. The type of *merula* is now over a hundred years old and if "foxed," as it may well be, might resemble *badia*, which in many respects is like the skins I have of the Guiana form, though much redder. Earlier confusion with *merula* may have been due to this cause.

#### SPECIMENS EXAMINED

*D. m. merula*.—FRENCH GUIANA: Pied Saut, 1 ♀. BRITISH GUIANA: Potaro Landing, 1 ♂; Tumatumari, 1 ♀; Minnehaha Creek, 1 ♀. BRAZIL: Faro, 1 ♀.

*D. m. badia*.—BRAZIL: Rio Tocantins, Pedral, 1 ♂ (type); Mocajuba, 1 ♀.

*D. m. castanoptera*.—BRAZIL: Rio Tapajoz (right bank), Diamantina, 1 ♂ (type)<sup>1</sup> 1 ♀<sup>1</sup>; Miritituba, 1 ♂<sup>2</sup>, 1 ♀<sup>2</sup>; Tauary, 1 (?).

<sup>1</sup>Specimens in U. S. National Museum, Washington, D. C.

<sup>2</sup>Specimens in Carnegie Museum, Pittsburgh.



*D. m. olivascens*.—BRAZIL: Rio Tapajoz (left bank), Limoã, 3 ♀; Rio Amazonas (south bank), Villa Bella Imperatriz, 2 ♂, 2 ♀.

*D. m. remota*.—BOLIVIA: Río Yapacani, 1 ♂ (type)<sup>1</sup>; Río Surutú, 1 ♀.

*D. m. barilletti*.—BRAZIL: Rio Madeira (left bank), Rosarinho, 1 ♂, 2 ♀; Rio Negro, Mt. Curycuryari, 1 ♀; Yucabi, 1 ♂; Tatú, 2 ♂, 1 ♀; Rio Uaupés, Tahuapunto, 1 ♀; Iauarete, 1 ♀. VENEZUELA: Suapure, 1 ♂, 1 ♀; Río Orinoco, 1 km. above Ihuapo, 1 ♀; Río Cassiquiare, Solano, 1 ♀; El Merey, 1 ♀; Mt. Duida, Río Pescada, 1 ♀; Valle de los Monos, 1 ♂; "Campamento del Medio," 2 ♀. PERÚ: Orosa, 1 ♀; Río Ucayali, Lagarto, 1 ♂, 2 ♀.

### *Dendrocincla fuliginosa phaeochroa* Berlepsch and Hartert

*Dendrocincla* (sic) *phaeochroa* BERLEPSCH AND HARTERT, 1902, Novit. Zool., IX, p. 67—Munduapo, Río Orinoco, Venezuela; ♂; Rothschild coll., Amer. Mus. Nat. Hist.

A series of sixty-seven skins from many parts of the range of this form, and one hundred and thirty-seven specimens of all the neighboring closely related forms, has permitted a careful study of their affinities.

The most interesting discovery has been that of the extension of range of *atrostris* to the south bank of the Amazon between the Madeira and Tapajoz rivers and its unquestionable association with *fuliginosa* which, in turn, appears to be the eastern representative of the *meruloides* group. Certain examples of *phaeochroa* have noticeable suggestions of pale streaks on the chest which are variable in *fuliginosa* and sometimes not very strongly developed. Furthermore, the supra-auricular stripe of *fuliginosa* is somewhat variable in prominence, though always distinct, but in all skins of *phaeochroa* there is a definite development of narrow, pale cinnamonous spots on the feathers of this region which occasionally are as well marked as in some examples of *fuliginosa*. A certain similarity in all particulars is striking.

Specimens of *fuliginosa* from south of the Amazon are definitely duller and more olivaceous brown, particularly below, than the northern birds and warrant the reinstatement of *rufo-olivacea* Ridgway of which *wallacei* Chubb is a synonym.

I concur with Chapman (1926) and Griscom (1932) in being unable to separate *christiani* Bangs from *ridgwayi* Oberholser. As Chapman pointed out, there is much variation in the birds of the western coast, but none which has any geographical significance. Central Colombian specimens (Cauca and Magdalena valleys) agree with Santa Martán skins and belong to *lafresnayeri*. The north coast of Venezuela and the islands of Trinidad and Tobago are inhabited by a single form, *meruloides*.

Two skins of *meruloides* at hand are labeled as from British Guiana, collected by Alexander, but no later collectors have ever obtained this

<sup>1</sup>Specimens in Carnegie Museum.

form in that country nor are the exact localities known where Alexander worked. The label is a tag of the Lawrence Collection, not in the collector's handwriting, and unquestionably was attached long after the specimen was collected. A third Alexander skin is similarly labeled "Trinidad or Venezuela." No reliance can be placed on the records of these skins.

In *phaeochroa* there is some slight variation which is not pronounced enough to warrant subdivision of this subspecies. Specimens from eastern Colombia, at the foot of the eastern Andes, are somewhat more richly colored than typical examples, approaching *lafresnayeri*. The series at hand from the Rio Negro is inseparable from southwest-Venezuelan skins. East-Ecuadorian, Peruvian, and west-Brazilian (south of the Amazon) specimens are occasionally slightly duller in coloration and show more regular traces of nearly obsolete pale shaft-lines on the top of the head, but there is no constant difference even of this slight nature. The tendency, apparently, is toward *atrirostris*.

I have not yet been able to examine the young bird in the Rothschild collection from Humaythá, Rio Madeira (left bank) referred by Hellmayr to *fuliginosa*; according to Hellmayr's account it is quite young and possibly indeterminable. Since *phaeochroa* is found lower down on the same side of the river, the record probably needs transference to this latter form.

The records of *fuliginosa* from Borba, however, appear to be more substantial. Dr. Hellmayr has kindly restudied the specimens in the Vienna Museum and writes me in detail about them, and from the description there is no doubt that they belong to *fuliginosa* and not to *atrirostris*. I have no skins from this locality, though some from Villa Bella Imperatriz, very little to the eastward and nearer the Amazon, are unquestionably *atrirostris*. Possibly *fuliginosa* crosses the Amazon to a very restricted area at the mouth of the Rio Madeira, but more material from Borba is needed to clear up the confusion.

Records of *phaeochroa* from Perú are from Iquitos, Huambo, and Río Tigre, to which the collection in hand adds several new localities.

#### SPECIMENS EXAMINED

*D. f. fuliginosa*.—FRENCH GUIANA: Pied Saut, 1 ♂; Tamanoir, 1 ♀. DUTCH GUIANA: Paramaribo, 2 (?). BRITISH GUIANA: Tumatumari, 1 ♂, 1 (?); Potaro Landing, 1 ♀; Kaietur, 1 ♂. BRAZIL: Faro, 6 ♂, 2 ♀.

*D. f. rufo-olivacea*.—BRAZIL: Rio Tocantins, Baiao, 3 ♂, 1 ♀; Cametá, 1 ♂; Utinga, Pará, 1 ♀; Rio Xingú, Villarinho do Monte, 3 ♂, 2 ♀; Porto do Moz, 3 ♂, 1 ♀; Rio Tapajoz (right bank), Santarem, 1 ♂, 1 ♀; Caxiricatuba, 1 ♂, 3 ♀, 1 (?).

*D. f. atrirostris*.—BRAZIL.—Rio Tapajoz (left bank), Igarapé Brabo, 1 ♂;

Igarapé Amarin, 2 ♂, 1 ♀; Limoal, 1 ♂; Ynajatuba, 1 ♀; Rio Amazonas, Villa Bella Imperatriz, 1 ♂, 3 ♀. BOLIVIA: Mission San Antonio, Río Chimoré, 2 ♂, 3 ♀.

*D. f. phaeochroa*.—BRAZIL: Rio Madeira (left bank), Rosarinho, 1 ♂, 1 ♀; Teffé, 1 ♀; Rio Negro, Muirapinima, 1 ♂; Tabocal, 1 ♂, 2 ♀; Santa Isabel, 1 ♂; San Gabriel, 1 ♀; Tatú, 1 ♂, 2 ♀; Rio Uaupés, Iauarete, 1 ♂. VENEZUELA: Río Cassiquiare, Buena Vista, 1 ♂; Solano, 1 (?); El Merey, 3 ♂, 1 ♀; opposite El Merey, 1 ♂, 1 ♀; junction of Río Huaynia and Río Cassiquiare, 1 ♀; Río Orinoco, mouth of Río Ocamo, 1 ♀; Mt. Duida, Valle de los Monos, 3 ♂, 2 ♀; Esmeralda, 5 ♂, 1 ♀; Lalaja, 1 ♂; "Savana Grande," 1 ♀; "Playa del Río Base," 1 ♀; "Primer Campamento," 1 ♂; "Campamento del Medio," 2 ♂, 4 ♀; Río Pescado, 1 ♀; (western) foot of Mt. Duida, 1 ♂; Boca de Sina, Río Cunucunumí, 1 ♀; Río Caura, La Unión, 1 ♂; Suapuré, 2 ♂; La Cascabel, Río San Feliz, 1 ♀; COLOMBIA: Villavicencio, 2 ♂, 1 ♀; Barrigon, Río Meta, 1 ♀. ECUADOR: below San José, 2 ♀; Río Suno, above Avila, 1 ♀; mouth of Río Curaray, 1 ♀. PERÚ: Puerto Indiana, 1 ♀; Anayacu, 1 ♀; Pomará, 1 ♂, 1 ♀; Río Seco, west of Moyobamba, 1 ♂, 1 ♀; Sarayacu, 1 ♀; Lagarto, upper Ucayali, 1 ♀.

*D. f. lafresnayei*.—COLOMBIA: Río Lima, 1 ♂; Botero, 1 (?); Honda, 1 ♂; Río Frio, 2 ♀; Puerto Valdivia, 1 ♀; (Santa Marta region), 1 (?); Las Nubes, 1 ♂, 1 (?); Onaca, 1 ♀; Minca, 1 (?); Valparaiso, 1 ♂, 1 (?).

*D. f. meruloides*.—VENEZUELA: Tucacas, Estado Falcón, 2 ♂; El Limón, 1 ♀; Las Trincheras, Estado Carabobo, 2 ♀, 1 (?); Quebrada Secca, 2 ♀; El Guayabal, 1 ♀; Cristóbal Colón, 3 ♂, 4 ♀; Río Neveri, 1 ♂, 1 ♀. TRINIDAD: Carenage, 1 ♂, 1 ♀; Caparo, 1 ♂; Princetown, 5 ♂, 2 ♀, 1 (?). TOBAGO: 1 ♂.

*D. f. ridgwayi*.—ECUADOR: Río de Oro, 3 ♂, 1 ♀; Zaruma, 1 ♂, 1 ♀; Coco, Río Chimbo, 1 ♀; Río Jubones, 1 ♂; Alamor, 1 ♂; Santa Rosa, 1 ♀; Esmeraldas, 1 ♀; Naranjo, 3 ♀; Chongon Hills, 1 ♂; Chone, 2 ♂. COLOMBIA: Nóvita, 1 ♂, 1 ♀; Baudo, 1 ♀; Barbacoas, 1 ♂. PANAMÁ: Tacarcuna, 2 ♂, 5 ♀; (Lion Hill), 1 (?); Barro Colorado Island, 1 ♂, 1 ♀; Tapalisa, 1 ♂; Capetí, 1 ♀. COSTA RICA: Guacimo, 1 ♂, 1 ♀; Bonilla, 2 ♀; Atalanta, 1 ♂; Volcan Turrialba, 1 ♂.

# AMERICAN MUSEUM NOVITATES

Number 729

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

June 6, 1934

56.1 (1183:79.4)

## A PLIOCENE FLORA FROM THE EDEN BEDS

BY DANIEL I. AXELROD<sup>1</sup>

A small collection of well-preserved leaves and seeds from the Eden beds of Riverside County, California, includes elements of the living endemic flora of central and southern California whose occurrence has been scanty or absent in the fossil record. This material was collected near Beaumont by Guy Hazen, and has been sent by Childs Frick to the University of California for study.

The fossil locality is situated about two miles south of Beaumont in a lower portion of the Eden beds, the plant-bearing deposits extending over an area of about two miles.

The sandstones and shales of the Eden formation, originally described by Frick<sup>2</sup> and as more recently observed by Fraser,<sup>3</sup> consist of two members:

(1) The Eden beds proper, which have the same dip and strike as the underlying red beds, and an approximate thickness of 1,500 feet. Minor faults are responsible for the chief disturbance of the Eden member, as it is located between two major fault zones.

(2) The underlying red beds, which are about 1,800 feet thick and were deposited by streams flowing from igneous and metamorphic areas into an arid, flatter country which acted as a basin of deposition. These red beds strike northwest with a low to moderate dip, and exhibit a number of breaks and small faults.

In general the red beds have greater continuity and are broken and displaced to a smaller extent than the overlying Eden beds, indicating that the movements must have been chiefly post-Eden. The greater disturbance of the overlying Eden beds is due to their general lack of induration and tendency to slump. Following the Eden deposition on the red beds, the area was faulted and uplifted with northward tilting, accompanied and followed by erosion. The Eden beds proper, according to Frick,<sup>4</sup> of the Uppermost division of the Pliocene, afford the best-known representation of a mammalian fauna of the American Uppermost Pliocene.

---

<sup>1</sup>University of California.

<sup>2</sup>Frick, C. 1921. 'Extinct Vertebrate Faunas of the Badlands of Bautista Creek and San Timoteo Cañon, Southern California.' Univ. Cal. Pub., Bull. Dept. Geol. Sci., XII, No. 5, pp. 283-288 and 339, top, 'The red phase.'

<sup>3</sup>Fraser, D. M. 1931. 'Geology of San Jacinto Quadrangle South of San Geronio Pass, California.' State Cal. Div. Mines, XXVII, No. 4, pp. 511-516.

<sup>4</sup>Frick, C. 1933. 'New Remains of Trilophodont-Tetralodont Mastodons.' Bull. Amer. Mus. Nat. Hist., LIX, Art. IX, p. 516 (faunal list).

Following is the list of thirteen genera recognized. Six forms are referred to fossil species previously recorded from the Pliocene<sup>1</sup>; the remainder are not represented in the collection by sufficient material to warrant their description as new species, and their close resemblance to modern species is indicated. Nine species are represented by leaves, three by seeds and three by cones containing seeds. Several wood fragments, leaves and seeds have not yet been identified.

PRELIMINARY LIST OF FOSSIL SPECIES AND THEIR MODERN EQUIVALENTS

FOSSIL SPECIES	MODERN EQUIVALENTS
<i>Arctostaphylos</i> sp.	<i>Arctostaphylos</i> sp.
<i>Ceanothus</i> sp.	<i>Ceanothus cuneatus</i> (Hooker) Nuttall
<i>Cercocarpus cuneatus</i> Dorf	<i>Cercocarpus betuloides</i> Nuttall
<i>Gramineae</i> sp.	<i>Gramineae</i> sp.
<i>Juglans</i> sp.	<i>Juglans californica</i> S. Watson
<i>Pinus</i> sp.	<i>Pinus coulteri</i> Don
<i>Pinus pieperi</i> Dorf	<i>Pinus sabiniana</i> Douglas
<i>Platanus paucidentata</i> Dorf	<i>Platanus racemosa</i> Nuttall
<i>Platanus</i> sp.	<i>Platanus wrightii</i> S. Watson
<i>Populus fremontii</i> Dorf	<i>Populus fremontii</i> Watson
<i>Prunus</i> sp.	<i>Prunus andersonii</i> Gray
<i>Pseudotsuga</i> sp.	<i>Pseudotsuga macrocarpa</i> Mayr
<i>Quercus lakevillensis</i> Dorf	<i>Quercus agrifolia</i> Née.
<i>Salix coalingensis</i> Dorf	<i>Salix lasiolepis</i> Benthams
<i>Sapindus</i> sp.	<i>Sapindus</i> sp. ( <i>S. drummondii</i> Hooker and Arnold?)

Six types of habitats appear to be represented by the vegetation now known from the Eden beds. Remains of monocotyledonous leaves are abundant in the collection and have been referred to *Gramineae* sp. The presence of grasses during the Eden epoch is corroborated by the occurrence in these beds of such grazing mammals as *Pliohippus* and *Pliauchenia*. The grasses probably occurred as a savannah rather than as a true grassland.

Several walnut fruits in the collection are closely similar to those of *Juglans californica* which today grows along the stream bottoms of the savannah and lower chaparral in southern California. Here it is commonly associated with *Salix lasiolepis*, *Platanus racemosa*, and *Populus fremontii*, all of which are represented in the Eden flora by the closely related fossil species *Salix coalingensis*, *Platanus paucidentata*, and *Populus fremontii*. Several complete seeds of *Prunus* have their closest living equivalent in *P. andersonii*, whose present distribution is on the arid slopes and canyons of the desert ranges leading into the desert proper.

<sup>1</sup>1933. Op. cit., p. 517, footnote.

*Platanus* sp. (cf. *P. wrightii*) and *Sapindus* sp. (cf. *S. drummondi*), which are represented in the material by several leaves and a seed respectively, constitute a desert element which is no longer found in California. *Platanus wrightii* occurs in Arizona, New Mexico, and southward into Sonora, replacing *Platanus racemosa* in the desert stream courses; this latter species shows no tendency to follow desert drainage lines into the desert proper. On the basis of one seed it was not possible to determine the modern equivalent of the *Sapindus* sp., but according to the present distribution of this genus and the general ecologic conditions indicated by the flora, *S. drummondi* Hooker and Arnold is its probable living equivalent. In this desert habitat it is associated with *Platanus wrightii* and *Populus fremontii*, this latter form often extending down into the desert from its savannah riparian habitat.

*Arctostaphylos*, *Ceanothus* and *Cercocarpus*, all represented by leaves in the flora, are characteristic genera of the chaparral throughout southern California. A number of well-preserved leaves of *Quercus lakevillensis* are present; its living equivalent *Q. agrifolia* is abundant in the chaparral on the cooler northern slopes.

*Pinus pieperi* is represented in the material by a number of complete cones and seeds. *Pinus sabiniana*, its modern descendant, now grows in the hot dry valleys and foothills surrounding the Great Valley of California, where it is commonly associated with *Quercus douglasii* Hooker and Arnold. A fragment of a leaf possibly referable to this species is in the material. At present *Pinus sabiniana* has its southernmost locality about 120 miles north of Beaumont in the Sierra Liebre Mountains, from here extending for about 500 miles into southern Shasta and Trinity counties.

*Pinus coulteri* is found today along the upper reaches of the chaparral, occasionally associated with the upper Digger Pine forest (*Pinus sabiniana*), extending from the coast and cross-ranges of southern California into Lower California. This pine is represented in the fossil flora by a cone with a number of well-exposed seeds. A number of cones are definitely referable to *Pseudotsuga macrocarpa*, which occurs on the upper limits of the chaparral in cool canyons and on north slopes throughout the mountains of southern and Lower California.

The general picture suggested by this composite flora is of a low-lying desert basin into which material was transported from several plant formations occurring on the adjacent mountain slopes. Growing along the drainage lines of the desert proper were *Platanus* (cf. *P. wrightii*), *Populus*, and *Sapindus*, while *Prunus* probably extended down the can-

yons of the arid desert slopes. Above this association a savannah of oaks and grasses existed, giving way on its upper edges to an open forest of *Pinus pieperi*. A chaparral cover of *Arctostaphylos*, *Ceanothus*, and *Cercocarpus* occurred scattered through and above this forest. Among the typical riparian elements, *Populus*, *Salix*, *Platanus paucidentata*, and *Juglans* ranged through the savannah and well up into the lower chaparral. *Pinus* (cf. *coulteri*) was present on the upper edges of the Digger Pine forest and chaparral; *Pseudotsuga* (cf. *macrocarpa*) was confined to the moister canyons and north slopes above this *Pinus* and chaparral belt.

Such an assemblage, with the exception of *Platanus wrightii*, *Sapindus* sp. and *Pinus sabiniana*, is today found down the eastern slope of the San Jacinto Mountains about 30 miles east of the fossil locality. A similar flora is likewise present approximately 60 miles east of Beaumont, on the slopes of the San Bernardino Mountains, facing the Colorado Desert.

The Eden flora is related to the Orinda and Etchegoin floras as described by Dorf,<sup>1</sup> which are located 360 and 220 miles north of Beaumont; like them it contains a high percentage of chaparral and riparian elements, indicating a semi-arid interior, stream-bank habitat. As already stated, Frick considers the Eden mammalian fauna as of an Uppermost Pliocene age. A comparison of the Eden flora with other California Pliocene floras indicates an age not older than Middle Pliocene.

The occurrence of a desert element comprising *Platanus* (cf. *P. wrightii*) and *Sapindus* is consistent with the southern occurrence of this fossil flora, and is indicative of more arid conditions during the Pliocene than exist at the fossil locality today. *Sapindus* and *Platanus* reach their best development in the desert under a rainfall of 5 to 10 inches annually, while the chaparral now growing at Beaumont exists under a rainfall of approximately 20 inches. Since the Pliocene there has been a return to more mesophytic conditions, a trend which is in agreement with the evidence presented by other California floras of this age.<sup>2</sup> With increased rainfall in the late Pliocene and Pleistocene, the desert elements probably retreated southward along available lines of migration, since these species are no longer found in California.

<sup>1</sup>Dorf, E. 1933. 'Pliocene Floras of California.' Contrib. to Paleontology, Carnegie Inst. Wash., Pub. No. 412, p. 25.

<sup>2</sup>Dorf, op. cit., p. 66.

# AMERICAN MUSEUM NOVITATES

Number 730

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

June 6, 1934

59.7, 58 S (729.9)

## A NEW GENUS AND SPECIES OF SCALELESS BLENNY, *SOMERSIA FURCATA*, FROM BERMUDA<sup>1</sup>

BY WILLIAM BEEBE AND JOHN TEE-VAN

The present paper forms part of a series dealing with the shore fishes of Bermuda, and is a result of the 1933 activities of the Bermuda Oceanographic Expedition of the Department of Tropical Research of the New York Zoological Society under the direction of Dr. William Beebe.

### BLENNIIDAE

#### *SOMERSIA*, new genus<sup>2</sup>

DIAGNOSIS.—Caudal fin forked; scaleless; lateral line single, confined to the anterior part of the body; teeth small, conical, not comblike, in a single row in the upper jaw; the lower jaw anteriorly with a double row, the outer row slightly larger than the inner; anterior teeth of both jaws slightly larger than the posterior, but not differentiated as canines; narial, supraocular and nuchal tentacles present; pelvic fins with 1 spine and 3 rays; dorsal and anal fin elements flexible, the spines similar to the rays; gill membranes joined together, but free from the isthmus.

GENOTYPE.—*Somersia furcata*, new species.

#### *Somersia furcata*, new species

TYPE.—No. 26,165, Bermuda Oceanographic Expeditions, Hungry Bay, Bermuda, November 12, 1933. Standard length 20.3 mm. Captured by Thatcher Adams of Paget, Bermuda. Type in the collections of the Department of Tropical Research of the New York Zoological Society.

FIELD CHARACTERS.—Very small, scaleless fish with pelvic fins reduced to a single spine and three short rays; caudal fin forked; lateral line on anterior portion of the body only; small tentacles present on the nape, above the eye and on the anterior nostril; gill membranes united to each other below, but free from the isthmus. Brown, dull-colored, obscurely blotched with darker.

MEASUREMENTS AND COUNTS.—Total length 25.5 mm.; standard length 20.3 mm.; depth 4.4 mm. (4.6 in length or 21.5%); head 5.7 mm. (3.57 in length or 28%); eye 1.6 mm. (3.55 in head or 7.8% of length); interorbital space 1.54 mm. (3.7 in head or 7.5% of length); snout 1.2 mm. (4.75 in head or 5.9% of length); maxillary 2.2 mm. (2.6 in head or 10.4% of length); pectoral ray count 14; pectoral fin length 3.8 mm. (18.8% of length); pelvic fin count I, 3; pelvic fin length 3.5 mm. (17.2% of length); dorsal fin count 26; anal fin count 20; caudal fin length 5.2 mm. (25.6% of length).

<sup>1</sup>Contribution No. 445, Department of Tropical Research, New York Zoological Society.

<sup>2</sup>After the Somers Isles.



Elongate, body compressed, especially posteriorly, the caudal peduncle deep. Anterior profile sloping evenly downward from the dorsal fin to the snout.

Skin naked. A transverse series of short tentacles on each side of the nape, consisting of 5 tentacles on a low broad base on each side. A low supraorbital tentacle. Anterior nostrils with a short tentacle, double pronged on the right hand side. Mucous pores present on the head.

Lateral line single, present on the anterior part of the body only, ending at the vertical of the origin of the anal fin, and consisting of 27 pores.

Head 3.57 in length, somewhat compressed, conical.

Opercles smooth, the preopercular margin with a very obtuse angle, the membranous portion of the opercle ending superiorly in a small flap.

Snout conical, 4.75 in head, shorter than eye.

Eye not quite round, fairly large, 3.55 in head, the upper margin slightly below the superior profile.

Anterior nostrils with a short tube and tentacle. Posterior nostrils rounded, without a tube and situated just above the vertical of the anterior margin of the eye.

Mouth terminal, rather small, the maxillary extending backward to the vertical of the center of the eye.

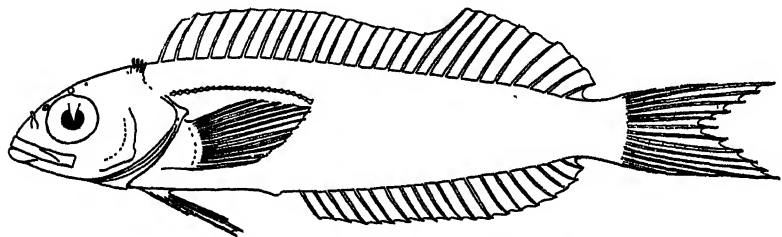


Fig. 1. *Somersia furcata*, type,  $\times \frac{1}{2}$ .

Teeth small, conical, curved inwardly, loosely attached to the jaw, but not comb-like or fastened to the skin of the lips. Lower jaw with a single series of very small teeth, conical, rather broad basally, the two teeth at the symphysis slightly larger than the others, the posterior teeth more widely spaced than the remainder. No posterior canines. Upper jaw with teeth similar to those of the lower, anteriorly in a double row, the outer teeth larger and heavier than the inner. Vomerine and palatine teeth absent.

Gill membranes joined to each other but free from the isthmus. Six branchiostegal rays.

Dorsal fin with 26 elements, the rays and spines flexible and not differentiable, the membrane of the fin loose and bulky, the upper margin of the fin highest posteriorly. Dorsal fin not joined to the caudal.

Anal fin with 20 elements, similar in form to the dorsal and not joined to the caudal.

Caudal fin forked, its central outer rays longer than either the middle or the outer rays, the tips of the longest rays extending about 2 millimeters beyond the central bifurcation.

Pelvic fins I, 3, inserted slightly posterior to the vertical of the preopercular margin, their tips not reaching the anus.

Color, one week after preservation in strong formalin: General color dull grayish-brown with a dull yellowish-white mottling which causes the sides to have a blotched appearance. Head slightly darker than rest of body. Dorsal and anal fins blotched with dark, the rays and spines darker than the membranes of the fins. Both of these fins with a narrow white edge, the white anteriorly confined to the tips of the spines. Caudal dusky along the rays.

This blenny is distinguished from most of the genera within its family by the possession of a strongly forked caudal fin, a character shared in the western Atlantic with *Ophioblennius* and some specimens of *Rupiscarte*. It differs from these genera in form and dentition. In many ways it is intermediate between some of the genera in Blenniidae proper and the other provisional families of naked blennies established by Jordan (1923) in the 'Classification of Fishes.'



# AMERICAN MUSEUM NOVITATES

Number 731

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

June 14, 1934

59.57, 99 M (728)

## THE SOCIAL BEES (MELIPONIDAE) OF BARRO COLORADO ISLAND, CANAL ZONE

BY HERBERT F. SCHWARZ

In a previous paper, consideration has been given to the solitary bees of Barro Colorado Island. The number of species of solitary bees seems small for the area in question and doubtless in course of time many species will be added to the list. In contrast, the number of social bees (all of the family Meliponidae or stingless bees) here reported upon probably represent much more nearly the actual number of species that inhabit the island. The better representation of these bees in the collections thus far made is not hard to explain. In contrast to many of the solitary bees, the Meliponidae in most instances are definitely associated with the forest or the fringes of the forest, and Barro Colorado, with the exception of a few small clearings, is heavily and continuously forested. Moreover, the visits of the stingless bees are not merely to flowers in search of pollen and of nectar but to a variety of other sites in search of building material or for other purposes. Hence, they are more in evidence than are the solitary species. Also, unlike the solitary bees, they are perennial, and a visitor to the island can as readily make the acquaintance of a given species of these stingless bees at one season of the year as at another. Although Barro Colorado is only about three miles in diameter and has an area of about 3840 acres, there have been taken within its confines thus far no less than twenty-six species and subspecies of Meliponidae. This is a rather surprisingly large number when it is considered that the known species and subspecies of Meliponidae listed by Lutz and Cockerell (1920) from all Central America, Mexico, and the West Indies, total only sixty-six, and that several of these perhaps may be considered as synonyms of other species enumerated in their list. The total is even more impressive if only the genus *Trigona* be considered. Of this genus there are twenty known species and subspecies on Barro Colorado compared with a total of forty-nine known species and subspecies recorded in Lutz and Cockerell's list for the rest of the Continent.

A key has been provided to the known stingless bees from Panama and the Canal Zone. In it have been incorporated, on the basis of a study of material loaned by various institutions, species in some cases not

previously reported from these regions; yet, even with these records included, there are only ten stingless bees known from this large area that have no representatives on Barro Colorado.

In the bibliographies that accompany each of the species mentioned no attempt has been made to cover the entire literature. For the purpose of this paper it has been deemed sufficient to give the bibliographical reference to the original description and to records of the occurrence of the particular insect in Panama or in the Canal Zone. Cases of synonymy have also been included in some cases.

Except when otherwise noted, all of the specimens here reported upon were collected on Barro Colorado Island.

KEY TO THE PANAMANIAN AND CANAL ZONE SPECIES OF MELIPONIDAE, BASED ON THE WORKER. THOSE SPECIES WITH AN ASTERISK (\*) ARE KNOWN TO OCCUR ON BARRO COLORADO ISLAND<sup>1</sup>

- 1.—The wings long, extending considerably beyond the tip of the abdomen. The stigma well developed, rather rounded below, subovate or ovate-lanceolate. Medium-sized to very small bees, ranging from 8 mm. down to 2 mm. in length (*Trigona* and *Lestrimelitta*).....2.
- The wings short, as a rule not extending beyond the tip of the abdomen. The stigma poorly developed, rather narrow and linear, tapering to a point apically, not rounded below. Large bees, rarely as short as 7 mm., more often from 9 mm. upward in length. (*Melipona*).....32.
- 2.—The outer surface of the hind tibiae gently and uniformly convex, the apical part of the joint being unmodified, without a depression or flattening; as a result, the worker suggests in its appearance a male. Head, thorax, abdomen above, and even the legs largely devoid of hair; black to dark brown and very shiny. Head large, with large malar spaces and a very short clypeus (*Lestrimelitta*).....*limão*.\*
- Hind tibiae with a more or less developed corbicula. (*Trigona*).....3.
- 3.—The marginal cell semi-open or imperfectly closed, the apical third or fourth of the marginal vein being vestigial to absent. Stigma large, approximately transparent, with usually a narrow, dark, encircling margin. The posterior border of the hind tibiae microscopically serrate. Very small bees,  $2\frac{1}{2}$  to  $3\frac{1}{2}$  mm. in length.....4.
- The marginal cell closed, the marginal vein being of virtually uniform thickness and clearly outlined to its extremity.....6.
- 4.—The coloration prevailing yellowish, dark areas being limited to the region occupied by the ocelli, the propodeum, apical bands sometimes on tergites 1-2 of the abdomen, the apex of the hind tibiae, and outer surface of hind basitarsi. The head and mesonotum rather lightly tessellated, semi-shiny.  
*atomaria*.

<sup>1</sup>There is not included in this key Cockerell's *opaca* described from Tabernilla, Canal Zone. I have not seen the type of this species. The description of it was based on the male, no worker being available. It seems to be close to *prosopeiformis*.

- The coloration black or prevailingly so. The head and mesonotum dull and lustreless due to exceedingly dense, granular tessellation. . . . . 5.
- 5.—The marginal vein with a very deep, semicircular, downward bend, the low point of the bend being distant from the costal margin of the wing about three times the greatest width of the stigma. Slightly larger, 3 to  $3\frac{1}{2}$  mm. *schultzei*.
- The marginal vein with the downward bend less emphatic, the low point of the bend being distant from the costal margin of the wing barely more than twice the greatest width of the stigma. Slightly smaller,  $2\frac{1}{2}$  to  $2\frac{3}{4}$  mm. *buyssoni*.\*
- 6.—The mesonotum smooth or nearly smooth, and shiny or at least moderately shiny even when covered with hairs. . . . . 7.
- The mesonotum either distinctly and strongly punctured, or with a dense, granular tessellation, or coarsely pitted. . . . . 27.
- 7.—The mandibles toothed from end to end along their biting edge, not merely on the inner half of it. The teeth usually distinctly separated but occasionally with thin intervening septa of chitin. The inner surface of the hind basitarsi with an oval area at the base that is either devoid of hair or covered with minute, appressed, sericeous hairs in sharp contrast with the erect brush on the apical half or two-thirds of the inner surface of the joint. . . . 8.
- The mandibles not dentate on their outer half. The differentiated area at the base of the inner surface of the hind basitarsi, with the exception of one species (*jati*\*), lacking. . . . . 15.
- 8.—The mandibles with three, usually distinct teeth along the outer half of the apex of the mandible; a fourth tooth or merely an angle at the inner end of the apex of the mandible. . . . . 9.
- The mandibles five-toothed, the two inner teeth sometimes very small. . . . 10.
- 9.—The abdomen fairly broad and of reddish-yellow color. . . . . *fulviventris*.\*
- The abdomen as a rule markedly narrower than the thorax due to lateral compression, with a resulting sharp dorsal carina; black. . . . . *compressa*.
- 10.—Dark-colored species. . . . . 11.
- Predominantly yellow or ferruginous species, with black only in limited areas if present at all. . . . . 14.
- 11.—The clypeus distinctly flattened, rising only barely above the sides of the face. The mandibles black from base to apex except for a narrow stripe of red just before the black apical teeth. The scape with ultramicroscopic, downlike, inconspicuous, very fine hairs. Relatively small bees,  $\frac{4}{4}$  to  $5\frac{1}{2}$  mm. . . . . *amalthaea*.\*
- The clypeus more arched, and apically foveate or with a slight, median, longitudinal depression. The mandibles extensively red or reddish brown, only the basal part sometimes dark, and the teeth dark. . . . . 12.
- 12.—The hind tibiae truncate at the apex and very broad. Erect, black hairs on the clypeus fairly abundant and on the whole longer than the hairs on the scape. The mandibles blackened or sooty over approximately their basal half or third, apically red or reddish brown except for the dark teeth. Length, 6 to 7 mm. . . . . *nigerrima*.\*

The apex of the hind tibiae slightly emarginate, with a sub-toothlike angle where the posterior contour and the apical contour meet. Erect black hairs on the clypeus lacking or inconspicuous and stunted. The mandibles red or reddish brown except for the black basal prominences and the teeth. . . . 13.

- 13.—The clypeus usually with a slight, median, longitudinal depression. The scape with short, coarse, somewhat bristle-like black hairs. The hair on the front coarse and of rather irregular growth, a little shorter but not differing otherwise in character from the hair on the vertex. Length,  $4\frac{3}{4}$  to  $5\frac{1}{2}$  mm.

*ruficrus corvina*.\*

The clypeus usually foveate only apically. The scape with merely fine, ultramicroscopic, downlike hairs (like those on the scape of *amalthaea*). The front with a low, even growth of ultramicroscopic hairs that are hardly traceable even when the insect is viewed from the side, and that contrast with the long, coarse hairs of the vertex. Length,  $6\frac{1}{2}$  to  $8\frac{1}{2}$  mm.

*trinidadensis* subspecies *silvestriana*.

- 14.—Virtually unstained by dark maculations, almost exclusively honey-colored.

*pallida*.\*

The head black except for the honey-colored clypeus, supraclypeal area, lower corners of face, and lower half of the genae; the mesonotum black, with narrow, honey-colored lateral and hind margins; a large, black spot below on the honey-colored mesopleura. . . . *pallida* subspecies *ferricauda*.\*

- 15.—The hind tibiae hollowed out deeply from apex to base, resembling the bowl of a spoon. . . . 16.

The hind tibiae of different structure. . . . 17.

- 16.—Almost exclusively black, a few pale markings on face and thorax excepted.

*testacea* subspecies *cupira*.\*

Honey-colored to the virtual exclusion of black. . . *testacea* subspecies *musarum*.

- 17.—The hind tibiae notably widened on their apical third to apical half, rather clavate. The posterior margin of the hind tibiae fringed not only with simple hairs but with branched hairs of usually shorter length (to note the feathered character of these hairs a microscope of large magnification is needed). . . . 18.

The hind tibiae more gradually widened, subtriangular, with the posterior apical angle sharp and distinct, sometimes even toothlike. Hairs on the posterior margin of the hind tibiae simple, without intermixed branched hairs. . . . 23.

- 18.—The abdomen broad and short, comparable in breadth to the thorax. The face black and immaculate, with many pale hairs. The apices of tergites 2–5 and all of tergite 6 rather densely covered with such pale hairs.

*subterranea* group.

The abdomen elongate, very distinctly narrower than the thorax, and as a rule rather quadrangular or subcylindrical in shape. . . . 19.

- 19.—Head, thorax, abdomen, and legs black (except that callows are sometimes ivory-colored in part, especially on some or all of the abdominal tergites). The hairs black. The wings hyaline at the base, milky white at the apex.

Honey-colored to a large extent, with black areas and markings, in addition to frequently yellow facial markings. . . . 20.

- 20.—The side-facial markings narrow and long, extending as a thin stripe along the inner orbit of the eye to its summit and usually rimming also the outer orbit discontinuously. . . . . *angustula doederleini*.  
The side-facial markings broad and short, filling or approximately filling the space between the clypeus and the eye and terminated by a truncation at or below the level of the base of the antennae. . . . . 21.
- 21.—The hind basitarsi with an oval area at the base of their inner side that is hairless or with appressed, sericeous hairs sharply differentiated from the brushlike hairs on the apical half of the inner side of the joint. Upper half of mesopleura black as well as lower half. Small, about  $3\frac{1}{2}$  to 4 mm. . . . . *jati*.  
Inner surface of hind basitarsi without a sharply differentiated basal region. At least upper half of mesopleura honey-colored although sometimes cloudy. Larger, 5 to 6 mm. . . . . 22.
- 22.—Tergites of abdomen rather uniformly honey-colored to reddish. . . . . *clavipes* subspecies *dorsalis*.  
Tergites 2-5 very broadly banded with black. . . . . *clavipes* subspecies *perangulata*.  
23.—Head exceedingly broad, at least one-third broader than long; the face hairless and for the most part honey-colored to yellowish with transparent areas. No stripes bordering the inner orbit of the eye and no stripes along the lateral margins of the mesonotum. . . . . *tataira* group.  
Head not much broader than long. The face with appressed, pale tomentum. Stripes bordering the inner orbits of the eyes and the lateral margins of the mesonotum. . . . . 24.
- 24.—Predominantly honey-colored, including the head and thorax, and in places transparent. Length,  $2\frac{1}{2}$  to 3 mm. . . . . *mosquito* subspecies *domiciliorum*,\* new subspecies.  
At least the head and thorax predominantly black. . . . . 25.
- 25.—The abdomen honey-colored, with usually a dark, transverse band at the extreme base of tergite 2 (overlapped by the transparent apical rim of tergite 1, with the result that the impression is created that it is the apical rim of tergite 1 that is banded). . . . . *mosquito* subspecies *jatiformis*.  
The abdomen predominantly black. . . . . 26.
- 26.—Very small, 2 to  $2\frac{1}{2}$  mm. in length. . . . . *minima (goeldiana)*.  
Larger, 3 to 4 mm. in length. . . . . *mosquito* subspecies *frontalis*.  
27.—The clypeus and supraclypeal region conspicuously raised, with large, coarse, relatively sparse punctures, contrasting strongly with the mostly dull and mostly much more finely and densely punctated surface of the sides of the face and the upper half of the head. The abdomen light yellowish-red in contrast to the predominantly black thorax and head, and almost devoid of erect hairs on the tergites. Hind tibiae greatly expanded. Large, about  $7\frac{1}{2}$  mm. to 8 mm. in length. . . . . *capitata* subspecies *zeemerniae*.  
The clypeus not especially prominent, its sculpturing not conspicuously coarser than that of the rest of the head, sometimes finer. The tergites of the abdomen largely or wholly black although in some species almost concealed by heavy bands of yellowish hair. Smaller, usually under 6 mm. . . . . 28.
- 28.—Eyes strongly convergent below. The lower half of the face, as well as the upper, covered with pale tomentum. Tergites 1-2 of the abdomen polished over most of their surface and shiny. . . . . 29.



- The eyes more nearly parallel-sided, the facial quadrangle very wide and the malar space very large. Lower half of the face bare and shiny. Tergites 1-2 of the abdomen dull, due to dense, granular sculpturing. . . . . 30.
- 29.—The mandibles strongly toothed from end to end along their biting edge, quadridentate. The mesonotum dull, due to exceedingly dense but fine, granular sculpturing, without bands along its sides. The hind margin of the scutellum entire or virtually entire.
- impunctata* subspecies *isopterothila*,\* new subspecies.
- The mandibles without teeth on the outer half of their apical edge. The mesonotum rugose, pitted with large, coarse, exceedingly deep punctures. The sides of the mesonotum banded with a yellow stripe that extends on to the axillae. The scutellum with a V-shaped emargination posteriorly, the two resulting V-shaped projections, one to each side of the emargination, likewise maculated. . . . . *testaceicornis*.\*
- 30.—The mesopleura, scutellum, and legs black. The tergites of the abdomen without bands of light-colored hairs. The whole lower half of the face, as well as the upper half, black or virtually black, with at most obscure vestiges of deep reddish traceable on the clypeus or on the sides of the face adjoining the clypeus. The venation of the wings and the stigma bright orange.
- postica* subspecies *luteipennis*.\*
- The mesopleura, scutellum, and legs fulvous or largely so. Dense bands of yellowish hairs along the apical margins of the tergites of the abdomen, only these bands being usually visible on the retracted apical tergites. . . . . 31.
- 31.—The hind tibiae fringed with ferruginous hairs. . . . . *pectoralis*.\*
- The hind tibiae fringed with black hairs. . . . . *pectoralis* subspecies *panamensis*.
- 32.—The lower half of the face highly polished, strongly shiny. The abdomen black (rarely deep brown), unbanded or (rarely) at most with a faint, brown line on the apex of the basal tergites, with exclusively black hair not only on the tergites of the abdomen but on the sternites as well. Venation of the wings bright orange. Robust, 11 to 13½ mm. . . . . *flavipennis*.\*
- The clypeus and the adjacent regions of the sides of the face dull, due to dense sculpturing. At least the femora, under side of thorax, and most or all of the abdominal sternites with pale hairs. . . . . 33.
- 33.—Tergites 3-5 of the abdomen with feebly developed, narrow, broken bands that are not infrequently completely effaced on one or more of these tergites. Erect, black hairs on tergites 3-6. . . . . *fasciata* subspecies *fasciata*.\*
- At least tergites 3-5 of the abdomen with strong, continuous, bright yellow bands. The hairs on the tergites mainly or wholly pale, and for the most part semi-erect to appressed; erect, black hairs, if present, confined especially to the apico-lateral region. . . . . 34.
- 34.—The bands on the abdominal tergites exceedingly broad, those on tergites 3-5 occupying most of the exposed part of the tergite to the subordination of the black basal part. The band on tergite 1 widely interrupted, that on tergite 2 less so. A thin, crescentic line of black or brown usually imbedded in each of the halves of the yellow bands on tergites 2-4. Relatively small, 7½ to 8½ mm. in length. . . . . *favosa* subspecies *phenax*.\*
- The bands on the abdominal tergites confined to the apical region, narrow when compared with the broad basal areas of black. The bands on tergites 1-2

- continuous like those on tergites 3-5. No imbedded dark lines in the yellow bands. Larger,  $8\frac{1}{2}$  to  $12\frac{1}{4}$  mm. .... 35.
- 35.—Tergite 6 (usually also to a lesser extent tergite 5) conspicuously clothed with feathery, white hairs, and intermixed with these on tergite 6 are long, slightly branched, black hairs, especially in the apico-lateral region. The scutellum black with usually a yellow, transverse line at apex. The angle at the posterior apical tip of the hind tibiae produced downward, distinctly spine-like. Somewhat larger,  $11\frac{3}{4}$  to  $12\frac{1}{4}$  mm. . *interrupta* subspecies *tripilaridis*.\*
- Tergite 6 with only simple hairs. The scutellum usually black or reddish brown basally, but almost invariably broadly yellow or yellowish red apically and on the posterior and lateral borders. The posterior apical tip of the hind tibiae usually less produced, more toothlike than spinelike. Smaller,  $8\frac{1}{2}$  to 11 mm. .... *beecheii* subspecies *beecheii*.<sup>1</sup>

### *Melipona flavipennis* Smith

*Melipona flavipennis* SMITH, 1854, 'Catalogue of Hymenopterous Insects in British Museum,' part 2, pp. 406-407.

*Melipona flavipennis* SCHWARZ, 1932, Bulletin Amer. Mus. Nat. Hist., LXIII, Art. 4, pp. 270-275 (Barro Colorado).

Workers, Nov. 12, 1923 (F. E. Lutz), and Jan. 10, 1929 (C. H. Curran). There is also a record in the card catalogue of the Laboratory on Barro Colorado of specimens collected by C. T. Greene, May 23, 1926, and determined by Rohwer.

In the British Museum are specimens of *M. flavipennis* collected by Champion at the Volcan de Chiriqui, Panama, and by Janson at Chontales, Nicaragua, which extend the range hitherto known for this insect.

### *Melipona interrupta* subspecies *tripilaridis* (Cockerell)

*Melipona fulvipes tripilaridis* COCKERELL, 1925, Annals and Mag. Nat. Hist., (9) XVI, p. 421 (Balboa, Canal Zone).

*Melipona fulvipes tripilaridis* COCKERELL, 1928, Psyche, XXXV, pp. 171, 173 (Balboa and Barro Colorado, Canal Zone).

*Melipona interrupta* subspecies *tripilaridis* SCHWARZ, 1932, Bulletin Amer. Mus. Nat. Hist., LXIII, Art. 4, pp. 286, 293, 298, 300, 304-305, 316 (Ancon, Balboa, and Barro Colorado Island, Canal Zone).

*Melipona interrupta tripilaridis* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 184-185 (Barro Colorado).

Workers were collected Nov. 9-10, 1923, by F. E. Lutz; Dec. 23, 1928, and Jan. 3, 1929, by C. H. Curran; March 3, 1933, by H. F. Schwarz.

Thus far this subspecies of *Melipona interrupta* has been reported

<sup>1</sup>This species is included doubtfully, since a specimen from Barro Colorado listed in the card catalogue of the Laboratory as *fulvipes*, a synonym of *beecheii*, may have been *interrupta* subspecies *tripilaridis*.

only from localities in the Canal Zone, and it is possible that its range is very restricted.

**? *Melipona beecheii* subspecies *beecheii* (Bennett)**

*Melipona Beecheii* BENNETT, 1831, in Beechey's 'Narrative of a voyage to the Pacific and Beering's Strait,' II, pp. 357-365. and plate.

In the Laboratory at Barro Colorado there is record of a specimen taken by C. T. Greene, April 14-18, 1926, and identified as *Melipona fulvipes* Guérin. The subspecies *fulvipes* is primarily confined to the West Indies and it is more likely that the insect is true *beecheii*. Even *beecheii*, however, is not known from any other locality in the Canal Zone, and it seems not improbable, therefore, that this insect was not even *beecheii*. My suspicion is that it was *M. interrupta* subspecies *triplaridis*.

***Melipona favosa phenax* (Cockerell)**

*Melipona phenax* COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 195.

*Melipona orbignyi jenningsi* COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 199 (Las Cascadas, Canal Zone).

*Melipona orbignyi phenax* COCKERELL, 1928, Psyche, XXXV, pp. 171-173 (Bella Vista, Ancon, Balboa, Canal Zone).

*Melipona favosa* subspecies *phenax* SCHWARZ, 1932, Bulletin Amer. Mus. Nat. Hist., LXIII, Art. 4, pp. 339-341 (Ancon, Balboa, Corozal).

In the card catalogue of the Laboratory on Barro Colorado there is record of specimens collected by N. Banks on July 12, 1924, and Aug. 7, 1924; the identification was made by the Museum of Comparative Zoölogy.

Regarding specimens collected at Ancon, Nov. 21, 1923, F. E. Lutz has the following field-note:

Had nests in walls of frame houses. Entrances at edge of windows. A little mud around the hole sometimes for an inch or two from the hole. Usually a bee on guard at the hole.

Another field observation of the same writer regarding a specimen collected Nov. 7, 1923, reads:

At a yellow "morning glory" near the Ancon Hospital.

Finally, at another locality in the Panama-Canal Zone region, namely Farfan, a specimen was collected by T. Hallinan "in bat cave."

***Melipona fasciata* subspecies *fasciata* (Latreille)**

*Melipona fasciata* LATREILLE, 1809, 'Recueil d'Observ. de Zool. et d'Anat. comparée faites par Humboldt et Bonpland,' I, p. 249, Pl. xvi, fig. 13.

A single worker was collected by F. E. Lutz on Nov. 22, 1930.

The typical subspecies of *fasciata* was described from Vera Cruz, Mexico, and has been reported from Costa Rica and Honduras. This is, I believe, the first record from the Canal Zone.

***Trigona amalthea* (Olivier)**

*Apis amalthea* OLIVIER, 1789, 'Encycl. méthod.', IV, Insectes, pp. 78-79.

*Trigona fuscipennis* FRIESE, 1900, Természettajzi Füzetek, XXIII, p. 385 (Panama).

*Trigona amalthea* COCKERELL, 1913, Psyche, XX, p. 10 (Las Sabanas, Panama).

*Trigona amalthea* RAU, 1933, in 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 27, 37 (Frijoles, Canal Zone).

Workers of this bee have been collected as follows: Nov. 13, 1923 (F. E. Lutz), Dec. 21, 1928, and Jan. 10, 1929 (C. H. Curran), Nov. 22, 1930 (E. I. Huntington).

There are also in the collections before me specimens from the following localities in the Canal Zone: Tabernilla, July 24, 1907 (A. Busck); Empire, May 8, 1909 (A. H. Jennings); Paraiso, Jan. 17, 1911, and March 25, 1911 (A. Busck); Corozal, March 1, 1912 (A. Busck), Feb. 23, 1914 (T. Hallinan), Jan. 22, 1929 (C. H. Curran), Nov. 17, 1930 (H. F. Schwarz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz), Nov. 24, 1930 (H. F. Schwarz); Ancon, Feb. 26, 1914 (T. Hallinan), April 14, 1924 (J. Zetek); Punta Patilla, Jan. 15, 1929 (C. H. Curran), Jan. 20, 1930 (H. F. Schwarz).

In the collections before me are also specimens of *amalthea* from the following localities in Panama: Alhajuela, April 11, 1911 (A. Busck); Cabima, May 18, 1911 (A. Busck); La Chorrera, April 12, 1912 (A. Busck); Chitré, April 25, 1922, on castor-oil plant (J. Zetek); Parita, April 27, 1922, on berries of *Coccoloba uvifera* Jacquin (J. Zetek); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Progreso, April 14-15, 1923 (F. M. Gaige).

***Trigona capitata zexmeniae* (Cockerell)**

*Trigona zexmeniae* COCKERELL, 1912, Annals and Mag. Nat. Hist., (8) X, pp. 313-314.

Workers of this bee were collected Feb. 18, 1929 (C. H. Curran), Feb. 27, 1933 (H. F. Schwarz), and March 4, 1933 (F. E. Lutz).

Other records from the Canal Zone are: Balboa, March 20, 1915 (T. Hallinan); Corozal, Jan. 19, 1929 (C. H. Curran).

***Trigona ruficrus corvina* Cockerell**

*Trigona ruficrus corvina* COCKERELL, 1913, *Psyche*, XX, p. 12 (Gatun, Canal Zone, and Las Sabanas, Panama).

*Trigona ruficrus corvina* WHEELER, 1913, observation on habits, *Psyche*, XX, p. 7 (Corozal and Gatun, Canal Zone).

*Trigona ruficrus corvina* COCKERELL, 1918, *Annals and Mag. Nat. Hist.*, (9) II, p. 482 (Chagres River).

*Trigona ruficrus corvina* COCKERELL, 1922, *Proc. U. S. Nat. Mus.*, LX, Art. 18, p. 8 (Punta de Peña, Panama).

*Trigona ruficrus corvina* ALLEE, 1926, *Ecology*, VII, p. 450 (Barro Colorado).

*Trigona ruficrus corvina* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 36-37, 216 (Barro Colorado and New Limon, Panama).

This subspecies has been collected as follows: Nov. 9-12, 1923 (F. E. Lutz), Nov. 12, 1923 (Sotero Murillo), March 25-26, 1924, and April 1-10, 1924 (J. C. Bradley), Jan. 11, 1929 (C. H. Curran), Nov. 14, 1930, and Dec. 1, 1930, "on dung of *Carnivora*, near rear lighthouse," and March 4-6, 1933 (H. F. Schwarz).

Other Canal Zone records are: Paraiso, Feb. 2, 1911 (A. Busck); Gatun, Nov. 11, 1911 (W. M. Wheeler); Ancon, (J. Zetek), Jan. 14-16, 1914 (T. Hallinan); Corozal, Feb. 23, 1914 (T. Hallinan); Balboa, June 28, 1914, and Nov. 18, 1914 (T. Hallinan), Nov. 19, 1930 (H. F. Schwarz); Culebra, Sept. 27, 1914, and Nov. 22, 1914 (T. Hallinan); Chagres River, Oct. 9, 1917, on *Citrus* (H. Morrison); Punta Patilla, June 15, 1929 (C. H. Curran); Summit, Nov. 26, 1930 (H. F. Schwarz).

The collections before me also contain specimens from the following localities in Panama: Punta de Peña, Aug. 6, 1906, on banana flowers (R. E. B. McKenney); Cabima, May 27, 1911 (A. Busck); La Chorrera, May 17, 1912 (A. Busck); Panama City, Feb.-March, 1915; Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Boquete, March 6-22, 1923 (F. M. Gaige); Progreso, April 15, 1923 (F. M. Gaige).

***Trigona nigerrima* Cresson**

*Trigona nigerrima* CRESSON, 1878, *Proc. Acad. Nat. Sci. Philadelphia*, p. 181.

The records for Barro Colorado are as follows: Dec. 21-30, 1928 (C. H. Curran), Nov. 8, 1930 (E. I. Huntington, on Wheeler Trail), Nov. 11, 1930 (H. F. Schwarz, on Drayton Trail).

This insect has been collected also at Tabernilla, July 20, 1907 (A. Busck) and at Trinidad River, May 7, 1911, on *Citrus* (A. Busck).

*Trigona nigerrima*, of which I have seen Cresson's type, is in my estimation an insect different from what is usually designated *silvestriana* Vachal. The material on which Vachal's description of *silves-*

*triana* was based was almost certainly composite, including specimens not only from South America but also from British Honduras. The South American specimens are the same insect that Provancher had previously described as *trinidensis*, of which I have likewise seen the type material, and the name *silvestriana* can survive only as a subspecies applicable to the British Honduras specimens in Vachal's collection. These presumably shared the characters that differentiate all the Central American examples of the species *trinidensis* that I have had occasion to examine from the South American representatives of the species. The characters peculiar to the Central American *trinidensis silvestriana* are:

The clypeus bare instead of with small erect hairs sparsely scattered over its surface. The front with a low even growth of ultramicroscopic hairs that are hardly traceable when the insect is viewed from the side. Contrasted with the coarse hair on the vertex, these minute hairs of the front seem of a different character and quality, whereas in the typical subspecies (*trinidensis*) the hairs on the front grade into those on the vertex and are coarse and uneven. The scape with merely fine, downlike hairs. Average size smaller,  $6\frac{1}{2}$  to  $8\frac{1}{2}$  mm. in length contrasted with 8 to 11 mm. for the worker of typical *trinidensis*.

Some of the differences between *Trigona nigerrima* and *Trigona trinidensis* subspecies *silvestriana* are indicated in the key. Of this subspecies there are before me representatives from the following localities in Panama: Bugaba (Schaus); Boqueron River, May 1907 (A. Busck); Changuinola District, Province of Bocas del Toro; Progreso, Province of Chiriqui, April 21, 1923 (F. M. Gaige).

#### **Trigona pallida subspecies pallida (Latreille)**

*Apis pallida* LATREILLE, 1804, Annales Mus. Hist. Nat., V, p. 177, Pl. XIII, fig. 14.

*Trigona pallida* WHEELER, 1913, Psyche, XX, p. 3 (Gatun, Canal Zone).

*Trigona pallida* COCKERELL, 1913, Psyche, XX, p. 10 (Gatun, Canal Zone, and Las Sabanas, Panama).

*Trigona pallida* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, pp. 463-464 (Tabernilla, La Chorrera, Rio Trinidad, and Alhajuela).

*Trigona pallida* COCKERELL, 1922, Proc. U. S. Nat. Mus., LX, Art. 18, p. 8 (La Chorrera, Panama).

*Trigona pallida* SCHWARZ, 1932, Natural History, XXXII, pp. 552-553 (Barro Colorado).

*Trigona pallida* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 37-38 (Barro Colorado).

The typical subspecies of *pallida* has been collected as follows: Nov. 12-18, 1923 (F. E. Lutz), April 14, 1924, including a queen (J. C. Bradley), Dec. 19-30, 1928 (C. H. Curran), Nov.-Dec. 1930 (F. E. Lutz, E. I. Huntington, H. F. Schwarz).

Other records from the Canal Zone are: Alhajuela, May 18, 1909 (A. H. Jennings) and May 28, 1912 (A. Busck); Paraiso, Feb. 2, 1911 (A. Busck); Gatun, Nov. 11, 1911 (W. M. Wheeler); Balboa, August 21, 1914, including a male, and Nov. 20, 1914 (T. Hallinan); Empire, Aug. 30, 1914, including a male (T. Hallinan); Arrijan Trail, Dec. 16, 1914, and Jan. 1, 1915 (T. Hallinan); Corozal, Jan. 16-19, 1929 (C. H. Curran).

The following localities of Panama are represented in the collections before me: Trinidad Rio, March 16, 1912 (A. Busck); La Chorrera, April 12, 1912 (A. Busck); Porto Bello Trail, May 30, 1915 (T. Hallinan); Las Sabanas, Nov. 17, 1923 (F. E. Lutz).

### ***Trigona pallida* subspecies *ferricauda* (Cockerell)**

*Trigona ferricauda* COCKERELL, 1917, *Psyche*, XXIV, pp. 127-128 (Porto Bello).

*Trigona pallida* variety *ferricauda* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 38 (Barro Colorado).

This insect has been reported from Barro Colorado by Rau, who observed it visiting the nectaries of the red flowers of *Hibiscus rosa sinensis*. Specimens have been collected also by C. H. Curran, Jan. 10, 1929; by H. F. Schwarz, Nov. 7, 1930, and Nov. 25, 1930; and by F. E. Lutz, March 18, 1933. The specimen of Nov. 7, 1930, was taken close to the trumpet-like entrance of the nest of *Trigona fulviventris* in the "Allee tree." It was crawling about in the vicinity of the nest but did not make an actual attempt to enter the nest.

Other records from Panama are: Porto Bello, April 18, 1912 (A. Busck); Chiriqui Grande, April 15-16, 1924 (J. C. Bradley); Changuinola Dist., Bocas del Toro, May 19, 1924 (F. R. Swift).

### ***Trigona fulviventris* Guérin**

*Trigona fulviventris* GUÉRIN, 1845, 'Iconographie du Règne animal,' III, p. 464.

*Trigona laboriosa* SMITH, 1862, *Trans. Ent. Soc. London*, (3) I, p. 42. (Panama).

*Trigona fulviventris* COCKERELL, 1920, *Bulletin Amer. Mus. Nat. Hist.*, XLII, p. 461 (Las Cruces, Porto Bello, Alafaela, Gatun, Paraiso, Alhajuela, Cabima).

"A red-bellied *Trigona*," LUTZ, 1924, *Natural History*, XXIV, pp. 495-496, 508 (Ancon, Fort Lorenzo).

*Trigona fulviventris* ALLEE, 1926, *Ecology*, VII, p. 450 (Barro Colorado).

*Trigona fulviventris* CHEESMAN, 1929, *Trans. Ent. Soc. London*, LXXVII, p. 150 (Cristobal).

*Trigona fulviventris* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 27, 38 (Barro Colorado and New Limon).

In the card catalogue of the Institute for Research in Tropical America the following records appear: March 23, 1926, and April 14-18, 1926 (C. T. Greene), identified by Rohwer; 1926 (W. C. Allee). In the collections before me are specimens of this species from Barro Colorado with data as follows: Nov. 11-13, 1923, including males as well as workers (F. E. Lutz), Dec. 26, 1928-Jan. 10, 1929 (C. H. Curran), Nov. 11-Dec. 1, 1930 (H. F. Schwarz), March 24, 1933 (H. F. Schwarz).

Many of these bees were collected from the nest in the "Allee tree." There has been a colony of *fulviventris* in the "Allee tree" for at least five years.

Other localities in the Canal Zone where *fulviventris* has been collected are: Tabernilla, July 23, 1907, a male (A. Busck); Paraiso, 1911 (A. Busck); Culebra, on Arrijan Trail, Nov. 27, 1914 (T. Hallinan); Gatun (A. H. Jennings); near Rio Trinidad, Gatun Lake, March 25-27, 1920 (Cornell Univ. Expedition); Ancon, Nov. 4, 1923, "nest under cement walk at foot of third post east of gate in fence along north side of main walk from Tivoli to railway station" (F. E. Lutz); Frijoles, Nov. 8-15, 1923 (F. E. Lutz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz); France Field, Jan. 18, 1929, males (C. H. Curran); Fort Davis, Feb. 9, 1929 (C. H. Curran).

Localities in Panama where *fulviventris* has been collected are: Porto Bello, Feb. 15, 1911 (A. Busck); Alhajuela, April 15-17, 1911 (A. Busck), May (A. H. Jennings), Aug. 16, 1914 (T. Hallinan); Cabima, May 27, 1911 (A. Busck); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Boquete, March 1-24, 1923 (F. M. Gaige); Progreso, April 14-21, 1923 (F. M. Gaige).

#### ***Trigona nigra* subspecies *parastigma* (Cockerell)**

*Trigona stigma* WHEELER, 1913, Psyche, XX, p. 5 (Las Sabanas).

*Trigona stigma* COCKERELL, 1913, Psyche, XX, pp. 11 and 14 (Las Sabanas).

*Trigona parastigma* COCKERELL, 1918, Annals and Mag. Nat. Hist., (9) I, p. 165.

*Trigona parastigma* CHEESMAN, 1929, Trans. Ent. Soc. London, LXXVII, p. 149 (Taboga Island).

*Trigona cressoni parastigma* LUTZ, 1933, Amer. Mus. Novitates, No. 641, pp. 1-26 (Barro Colorado).

Stingless bees (*Trigona*) LUTZ, 1933, Natural History, XXXIII, pp. 571-576 (Barro Colorado).

Workers have been collected as follows: Nov. 13, 1923 (F. E. Lutz), March 1-24, 1933 (F. E. Lutz, E. I. Huntington, H. F. Schwarz).

Specimens have been taken in other localities of the Canal Zone and adjacent regions of Panama as follows: Taboga Island, Feb. 22, 1912



(A. Busck), Nov. 23, 1923 (F. E. Lutz), and "at rotten fruit" (A. H. Jennings); Caledonia Road (A. H. Jennings); Alhajuela, May 27, 1918 (A. Busck); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz); Patilla Pt., Jan. 15, 1929 (C. H. Curran); Frijoles, Nov. 9, 1930 (H. F. Schwarz).

Wheeler noted (1913) a colony of this bee at Las Sabanas, near Panama City. His description of the nest entrance, "a slit shaped hole about  $\frac{1}{2}$  inch long and not provided with a waxen or cerumen spout," agrees with the conditions observed in a nest constructed in one of the wooden sides of the Laboratory on Barro Colorado. It is this species that Dr. F. E. Lutz tested as to its ability to recognize different geometric designs placed over and about its nest entrance and as to its ability to differentiate between white color that reflected ultraviolet and white color that did not (Lutz, 1933, Amer. Mus. Novitates, No. 641, pp. 1-26, and Natural History, XXXIII, pp. 571-576).

Specimens with creamy white abdomens are, as Cockerell has pointed out (1913), almost certainly callows. Even such immature specimens sometimes bear sticky building material on their hind tibiae, showing that they are already engaged in the work of the hive.

***Trigona clavipes* subspecies *perangulata* (Cockerell)**

*Trigona perangulata* COCKERELL, 1917, Psyche, XXIV, p. 125 (Alhajuela).

Workers of this species were collected by H. F. Schwarz on the following dates, mostly on the laboratory clearing on Barro Colorado: Feb. 26, 1933, March 4, 6, 9, and 24, 1933.

***Trigona clavipes* subspecies *dorsalis* (Smith)**

*Trigona dorsalis* SMITH, 1854, 'Catalogue of Hymenopterous Insects in British Museum,' II, p. 411.

*Trigona zieglerei* FRIESE, 1900, Természettajzi Füzetek, XXIII, p. 391 (Panama).

*Trigona dorsalis* COCKERELL, 1917, Psyche, XXIV, p. 128 (Alhajuela).

*Trigona dorsalis* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 28, 29-31 (Barro Colorado).

Rau (1933) has given an interesting account of a nest of this species on Barro Colorado. In addition to the specimens he collected, workers have been taken by C. H. Curran on Jan. 11, 1929, by H. F. Schwarz on March 6, 1933, and by F. E. Lutz on March 15, 1933.

This species is represented likewise in other localities of the Canal Zone and adjacent regions of Panama, having been collected at Alhajuela by A. Busck; Ancon, Feb. 8-12, 1916 (T. Hallinan); Las Sabanas,

Nov. 18, 1923 (F. E. Lutz); Patilla Point, Jan. 15, 1929 (C. H. Curran) and Nov. 20, 1930 (H. F. Schwarz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz), Nov. 24, 1930 (E. I. Huntington and H. F. Schwarz), and March 11, 1933 (H. F. Schwarz); Corozal, Jan. 21, 1929 (C. H. Curran).

### ***Trigona jaty* Smith**

*Trigona jaty* SMITH, 1863, Trans. Ent. Soc. London, (3) I, p. 507.

*Trigona jaty* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 461 (Tabernilla).

Workers of this species were collected: Dec. 22-27, 1928, Jan. 10, 1929, and Feb. 13, 1929 (C. H. Curran), March 5, 1933 (F. E. Lutz), March 22, 1933 (H. F. Schwarz).

Other localities in the Canal Zone and in Panama where this species has been collected are: Tabernilla, July 23, 1907 (A. Busck); Paraiso, Feb. 13, 1912 (A. Busck); Alhajuela, May 28, 1912, (A. Busck); Boquete, Chiriqui Province, March 9, 1923 (F. M. Gaige); Progreso, Chiriqui Province, April, 1923 (F. M. Gaige) on "ocean beach"; Changuinola District, Bocas del Toro, May 26, 1924 (J. C. Bradley).

### ***Trigona mosquito* subspecies *jatiformis* (Cockerell)**

*Trigona jatiformis* COCKERELL, 1912, Annals and Mag. Nat. Hist., (8) X, p. 311.

Workers collected, Nov. 1930, and March 22, 1933, by H. F. Schwarz.

It is possible that *jatiformis* is the typical subspecies of *mosquito*. Smith's type of *mosquito* is unfortunately a callow while his description is based on a mature specimen. The description itself does not make mention of stripes on the sides of the mesonotum, which are conspicuous in *jatiformis*.

A fairly large series of *jatiformis* was collected by F. M. Gaige at Progreso, Chiriqui. Province, Panama, April 14-20, 1933.

### ***Trigona mosquito* subspecies *frontalis* variety *flavocincta* (Cockerell)**

*Trigona frontalis flavocincta* COCKERELL, 1912, Psyche, XIX, p. 50.

*Trigona frontalis flavocincta* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 462 (Paraiso).

Three workers collected as follows: March 25-26, 1914 (J. C. Bradley), Dec. 29, 1928 (C. H. Curran), Dec. 4, 1930 (F. E. Lutz).

Two of the specimens are very close to what Cockerell (1912, Annals and Mag. Nat. Hist., X, p. 314) has designated *Trigona frontalis flavocincta* variety *a*. The variability of *mosquito* is very great and *frontalis* is one of its most unstable subspecies.

***Trigona mosquito* subspecies *domicilliorum*, new subspecies**

*Trigona mosquito* LUTZ, 1931, Amer. Mus. Novitates, No. 468, pp. 5-9 (Barro Colorado).

*Trigona mosquito domicilii* RAT, 1933 (without description), 'Jungle bees and wasps of Barro Colorado Island,' pp. 34-36 (Barro Colorado).

The head broader than long, smooth, rather shiny on the front, where it is semitransparent, and like the rest of the body honey-colored. A rather faded, cream-colored stripe banding the inner orbits of the eyes nearly or quite to their summit with invasions of cream-color on the clypeus, on the supraclypeal area, on the scape in front, on the labrum, and on the cheeks. The tips of the mandibles, which have two minute teeth on the inner half of their apex and are edentate on the outer half, slightly darkened; the apex of the scape (especially posteriorly) and the flagellum (especially above) blackened; a black stripe extends between the ocelli. Eyes converging below, in dead specimens grayish to blackish. The malar space small but distinct. The clypeus, front, and scape covered with a fine, pale, semiappressed tomentum; the vertex with longer, erect, pale hairs, and the inferior edge of the mandibles and to some extent also the labrum fringed with such hairs.

The thorax smooth, honey-colored, semitransparent in parts, usually so on the mesopleura, scutellum, and propodeum. The pronotum, tubercles, sides of mesonotum, axillae, and posterior margin of scutellum more or less feebly maculated with cream color. The mesonotum usually of somewhat mottled appearance. The hairs of the thorax pale, for the most part short, and of rather uniform distribution, conspicuously longer on the semicircular scutellum, and moderately long on the anterior edge of the mesonotum and on the inferior part of the mesopleura. The propodeum medianly bare.

The legs honey-colored, more or less semitransparent, with a little deepening of color sometimes on the posterior half of the outer surface of the hind basitarsi. The hairs pale, somewhat reddened on the hind metatarsal brushes, sparse on the femora, coarser on the tarsal joints of the fore and middle legs than they are on the tibiae of these legs. The hind tibiae fringed with simple hairs that are rather sparse and long. In contour the hind tibiae are subtriangular with a rather decided angulation at the posterior apical extremity. The hind basitarsi narrow, at their apex half or somewhat less than half the width of the corresponding tibiae at their apex.

The wings hyaline, with strong, metallic reflections of violet, green, and gold. The venation and stigma of not quite so clear a ferruginous as the tegulae, a little duller and diluted with brown.

The abdomen broad, short and rather flat, with the venter only mildly convex; smooth, concolorous with the rest of the body, usually semitransparent to transparent on tergites 1 and 2, which are hairless, slightly duller on the subsequent tergites, which are thinly covered with pale, semiappressed, inconspicuous hairs that are shorter than the hairs of the sternites.

Length,  $2\frac{1}{2}$  mm. to 3 mm.; width of thorax, 1 mm.; length of forewing, including tegula, 3 to  $3\frac{1}{4}$  mm.

Workers and males of *mosquito* can be differentiated structurally from the corresponding casts of *minima* virtually through their greater size only. The workers of the insect here described are intermediate in

size between typical *minima* and the smallest of the subspecies of *mosquito*. As the separation of *mosquito* and its subspecies on the one hand and *minima* on the other, if maintainable, is primarily on the basis of the architecture of the nest and the structure of the queen, and as the nest and queen of the insect here described are unknown, the allocation of *domiciliorum* as a subspecies of *mosquito* rather than of *minima* had better be considered tentative.

The present insect differs from all of the other subspecies of *mosquito* except *varicolor* Ducke in being almost wholly honey-colored with a minimum of black. The presence of black in *domiciliorum* is much more restricted than in *varicolor*, which has the upper third of the head and sometimes also the mesonotum black in whole or in part. A further distinction is that of size, *varicolor* resembling in this respect robust specimens of typical *mosquito*. The insect herein described is, on the other hand, smaller than typical *mosquito*.

This bee has thus far been recorded only from Barro Colorado. It figured in the interesting experiments made by Dr. F. E. Lutz and published under the title, 'Light as a factor in controlling the start of daily activity of a wren and stingless bees' (Amer. Mus. Novitates, March 31, 1931, No. 468). Mr. Phil Rau has contributed to the knowledge of its biology, in his 'Jungle bees and wasps of Barro Colorado,' 1933, pp. 34-36. The name *domicilii*, which I supplied to Mr. Rau, seems inadequate in view of the fact that nests of the insect have been noted in various buildings on Barro Colorado. As the name *domicilii* was published without description, I hereby replace it with the name *domiciliorum*.

The type material consists of workers collected March 25, 1924 (J. C. Bradley), Dec. 30, 1928, and Feb. 18, 1929 (C. H. Curran), Nov. 21-29, 1930 (F. E. Lutz and H. F. Schwarz). The holotype and twenty-six paratypes are in the American Museum; two paratypes are at Cornell University.

This bee is evidently preyed upon not infrequently by spiders. In company with Dr. F. E. Lutz I witnessed the leap of a salticid spider at a returning bee from the distance of about a foot. The spider spun a thread as it leaped and thus remained tethered to the spot from which the leap was made. In spite of the spontaneity of the action, the distance was very accurately gauged, for the spider barely missed its intended victim at the first try and on a second try achieved its purpose. Rau (1933, p. 36) tells of two species of salticid spiders (one of them *Marpissa magna*) that successfully took toll of the returning bees of this subspecies. Yet, although thus preyed upon by spiders, the tiny nest was not vio-

lated in a raid of *Eciton* ants that I witnessed in 1930, in spite of the fact that the marching column of ants almost skirted the nest as it scaled the wall of the building.

***Trigona minima* Gribodo**

*Trigona ? minima* GRIBODO, 1893, *Bulletino della Soc. Ent. Italiana*, XXV, p. 261.

*Trigona goeldiana* FRIESE, 1900, *Természetráji Füzetek*, XXIII, p. 391.

Workers collected by C. H. Curran, Dec. 30, 1928.

Ducke (1925) considered *goeldiana* Friese as a synonym of *minima*. Gribodo described his *minima* as having the abdomen and legs testaceous, whereas Friese described *goeldiana* as having the legs fuscous and the abdomen fuliginous. However, callow specimens in a series frequently approach the description of Gribodo and it is difficult to know where to draw the line. From Santarem, Brazil, the type locality of *minima*, there is a specimen before me that has the darker abdomen and legs noted for *goeldiana*, and of two specimens in the American Museum referred by Friese to *goeldiana* one has the abdomen dark and the other testaceous. The specimens from Barro Colorado accord with the description of Friese's *goeldiana* in the details wherein the description of *goeldiana* differs from the description of *minima*.

***Trigona testacea* subspecies *cupira* (Smith)**

*Trigona cupira* SMITH, 1863, *Trans. Ent. Soc. London*. (3) I, p. 507.

*Trigona cupira* COCKERELL, 1920, *Bulletin Amer. Mus. Nat. Hist.*, XLII, p. 464 (Cabima and Porto Bello Trail, Panama).

*Trigona cupira* COCKERELL, 1928, *Psyche*, XXXV, p. 171 (Canal Zone).

*Trigona testacea* subspecies *cupira* SCHWARZ, 1932, *Natural History*, XXXII, p. 552 (Barro Colorado).

*Trigona cupira* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 17-29 (Barro Colorado).

Workers were collected Nov. 9-10, 1923 (F. E. Lutz), Dec. 21, 1928, Jan. 4, 1929, and Jan. 11, 1929 (C. H. Curran), Nov. 10, 1930, Nov. 15, 1930, and Nov. 23, 1930 (H. F. Schwarz), Nov. 23, 1930 (E. I. Huntington), March 22, 1933 (F. E. Lutz).

The specimens collected Nov. 15, 1930, were taken on a peeled banana, the white surface of which was black with the visiting bees of this subspecies.

Attached to the Redwood House on Barro Colorado Island there was a nest of this subspecies within a structure of *Nasutitermes*. A nest of *rhumbleri*, another subspecies of *testacea*, was discovered in a structure of *Nasutitermes* at El Campamiento, Peru (Schwarz, 1929, *Jour. N. Y.*

Ent. Soc., XXXVII, pp. 145-149), and Ducke (1925, Zool. Jahrb. System. Geogr. u. Biol., LXIX, p. 410) remarks of *testacea* (which he has erroneously interpreted as *pallida*) that "As a tenant in the nests of tree-inhabiting termites this species (in all its subspecies) occurs frequently in Amazonia."

Specimens of *cupira* have been collected at Balboa, June 12, 1914, Aug. 20, 1914, and Nov. 8-17, 1914 (T. Hallinan); Culebra, July 4, 1914 (T. Hallinan); Culebra-Arrijan Trail, Nov. 29, 1914 (T. Hallinan); Farfan, Feb. 28, 1915 (T. Hallinan); Gamboa, Oct. 24, 1915 (T. Hallinan); Boquete, Chiriqui Province, March 8-29, 1923 (F. M. Gaige); Progreso, Chiriqui Province, April 20, 1923 (F. M. Gaige); Frijoles, Nov. 6, 1923 (F. E. Lutz), and Nov. 9, 1930 (H. F. Schwarz); Sabanas, Nov. 14, 1923 (F. E. Lutz).

Among the type material of *musarum*, one of the light-colored subspecies of *testacea*, were specimens collected on Boqueron River, Panama.

#### ***Trigona postica* subspecies *luteipennis* (Friese)**

*Trigona bipunctata* variety *luteipennis* FRIESE, 1901, Zeitschrift für Hymenop. und Dipterologie, I, p. 382.

*Trigona pachysoma* COCKERELL, 1917, Psyche, XXIV, pp. 125-126 (Porto Bello).

Workers of this insect have been collected as follows: Feb. 26-27, 1933, March 3-6, 1933 (H. F. Schwarz), March 5, 1933 (F. E. Lutz).

Other localities in Panama where specimens were taken include Santa Rosa on the Chagres River, March 13, 1933 (H. F. Schwarz) and Pacora, March 19, 1933 (H. F. Schwarz).

The obscure red spot on each side of the face noted by Cockerell in his description of *pachysoma* is in many of the specimens wholly or nearly absent, the whole lower half of the face, like the upper half, being black or virtually black. In other specimens, not only are the obscure reddish spots in evidence on each side of the face but the clypeus itself is a deep, dull chestnut red.

#### ***Trigona pectoralis* (Dalla Torre)**

*Trigona thoracica* CRESSON, 1878, Proc. Acad. Nat. Sci. Philadelphia, p. 181 (*nec* Smith).

*Trigona pectoralis* DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 582.

This species was taken Dec. 28, 1928 (C. H. Curran), and March 23, 1933 (F. E. Lutz and H. F. Schwarz).

A nest of this bee was observed in 1933 on the Lutz Trail between divisions 2 and 3. It was located in a tree that grew out from the side

of a bank and that partly overhung a stream bed. The nest was several feet from the base of the tree, placed midway between two converging buttresses. The entrance was a small trumpet, shaped a little like a morning-glory, with the mouth wider than the base; the circumference at the apical edge was approximately circular. The trumpet was very thin, almost paper-like or wafer-like and of a light brown color. On one side it was attached to the tree and hence it could not be removed in toto. Its partial removal took place on the afternoon of March 23. Upon revisiting the nest site the following morning at 9 o'clock, I was interested to note that the removed trumpet had been almost completely replaced by a new trumpet, of the same color and apparently of the same consistency, shaped, in so far as it had been completed, like the former trumpet and like it attached on one side to the tree.

Wheeler (1913, *Psyche*, XX, p. 6) noted a colony of this bee in Guatemala. It, too, had chosen as its nest-site a tree growing on the bank of a stream.

It is to be noted that the specimens collected on Barro Colorado tend to align themselves with *pectoralis* proper. Other examples taken in Panama and the Canal Zone are assignable to *pectoralis panamensis*, which Cockerell described (1913, *Psyche*, XX, p. 112) from Las Sabanas, Panama. Of the latter there are specimens in the American Museum from the following localities: Ancon, Feb. 27, 1914 (T. Hallinan); Balboa, June 19, 1914, Aug. 25, 1914 (T. Hallinan); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz); Patilla Pt., Jan. 15, 1929 (C. H. Curran); Fort Davis, Feb. 9, 1929 (C. H. Curran); Corozal, Jan. 31, 1929 (C. H. Curran), Nov. 17, 1930 (H. F. Schwarz); Pacora, March 19, 1933 (H. F. Schwarz).

Cockerell (1928, *Psyche*, XXXV, p. 172) reported the race *panamensis* from Balboa, and Cheesman (1929, *Trans. Ent. Soc. London*, LXXVII, p. 149) reported it from Taboga Island.

### **Trigona (Nannotrigona) testaceicornis** Lepeletier

*Melipona (Trigona) testaceicornis* LEPELETIER, 1836, *Hist. nat. Insect., Hymén.*, I, p. 429.

*Trigona mellarius* SMITH, 1862, *Trans. Ent. Soc. London*, (3) I, p. 42 (Panama).

*Nannotrigona testaceicornis* COCKERELL, 1928, *Psyche*, XXV, p. 171 (Balboa, Canal Zone).

*Nannotrigona testaceicornis* CHEESMAN, 1929, *Trans. Ent. Soc. London*, LXXVII, p. 150 (Taboga Island).

*Nannotrigona testaceicornis* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 38 (Barro Colorado).

The Barro Colorado records of this bee in the collection before me are as follows: Nov. 12, 1923 (F. E. Lutz), Dec. 27, 1928, and Jan. 3, 1929 (C. H. Curran), March 23-24, 1933 (H. F. Schwarz), March 23, 1933 (E. I. Huntington).

There are also specimens from Tabogilla Island, Feb. 18, 1912 (A. Busck); Taboga Island, Feb. 22, 1912 (A. Busck), and Nov. '23, 1923 (F. E. Lutz); Trinidad River, June 2, 1912 (A. Busck); Farfan, Feb. 28, 1915, a male, (T. Hallinan); Balboa, Nov. 7, 1923, "at a yellow morning glory" (F. E. Lutz); Las Sabanas, Nov. 17, 1923 (F. E. Lutz).

***Trigona impunctata* subspecies *isopterophila*, new subspecies**

Worker.—Like the typical subspecies but with the maculations that characterize the latter subdued or absent. The transverse stripe that occurs in the typical subspecies just before the apex of the clypeus extinguished except for a surviving spot of yellow at its center; the narrow stripe along the inner orbit of the eye very dull. The thorax virtually immaculate: no stripes bordering the mesonotum laterally; at most a very dull red spot on the axillae and an abbreviated dull red line on the apical tip of the scutellum (even these faint vestiges of maculation sometimes absent).

Ducke speaks of the mandibles of *impunctata* subspecies *impunctata* as tridentate and so they appear when partly concealed beneath the labrum, but, when fully exposed, they prove to be quadridentate.

A colony of *impunctata* subspecies *isopterophila* was found by C. H. Curran in a deserted termite nest. Workers from this colony were collected by him Jan. 10, 1929. A specimen was also collected by F. E. Lutz, Dec. 3, 1930.

Dr. Curran has kindly supplied the following note reporting his observations on the nest:

The nest of this interesting *Trigona* was found in a deserted termite nest on a small palm tree having a circumference of about eighteen inches. The termite nest was small, about a foot high and approximately eight inches across, and located between eight and nine feet from the ground. In the face of the nest, that is to say in the surface opposite the axis of the palm trunk, was the entrance to the *Trigona* nest, a small hole, large enough for the passage of only one insect at a time.

On some occasions while the nest was under observation the bees were returning at the rate of approximately two a minute, but as a general rule only about half this number were observed. The peculiar attraction of the domicile was due to the habits of the bees, particularly the presence of a door-keeper, a habit I had not previously observed, although the phenomenon has not passed unnoticed by others. While there was no activity, the head of this guardian completely filled the entrance and as a result it was apparent only under close scrutiny and in good light, and it would easily have passed unnoticed had its presence not been known or attention attracted to it by the returning and departing bees. As a returning bee neared the nest, the head of the door-keeper would disappear and there was no loss of time in the entrance of the



worker. Rarely did the returning bee find it necessary to alight before the guardian's head would disappear from the opening and, no sooner had the worker entered, than the entrance was once more blocked. Unfortunately, the nest was too high above the ground to determine whether the same bee acted as guard continuously, but the alacrity with which it performed its duties would seem to indicate that this was so for at least a considerable period. The nest was evidently a small one and only a few bees were captured.

The type material of *Trigona impunctata* subspecies *isopterophila* is in the American Museum.

#### **Trigona near lineata** Lepeletier

*Trigona near lineata* ALLEE, 1926, Ecology, VII, p. 450 (Barro Colorado).

It is possible that this is the insect here designated *Trigona impunctata* subspecies *isopterophila* or, again, it might be what Cockerell (1917, Psyche, XXIV, pp. 126-127) described from the male as *Trigona opaca*, the type locality of which is Tabernilla, Canal Zone.

#### **Trigona buyssoni** Friese

*Trigonabuyssoni* FRIESE, 1902, Zeitschrift für Hymenop. und Dipterologie, p. 383.

*Trigona townsendi* COCKERELL, 1911, Annals and Mag. Nat. Hist., (8) VIII, p. 286.

*Trigona townsendi* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 465 (Alhajuela).

Workers were collected by C. H. Curran on Dec. 29, 1928, and Jan. 7, 1929.

I have also seen specimens of *buyssoni* from Bugaba, Panama, collected by Champion.

*Trigona buyssoni* and *Trigona townsendi* were both described from Peru. I have compared a specimen from Escuintla, Guatemala, identified by Cockerell as *townsendi* with a type specimen of *buyssoni* from Vilcanota, Peru, and believe them to be the same insect.

Wheeler (1913, Psyche, XX, p. 5) found a single specimen of this bee in a nest of *Trigona frontalis* and expressed the opinion that it is in all probability an inquiline. This seems doubtful in view of the fact that the structurally similar *duckei* and other closely related forms among the *Trigona* are known to construct a nest, although the cells are not arranged in combs. Moreover, one of the specimens of *buyssoni* before me has pollen massed at the apex of its tibiae, an indication that the species leads an industrious life.

A close relative in Central America of *Trigona buyssoni* is *Trigona schulthessi*. Of this species there is a series from Progreso, Chiriqui Province, Panama, collected on April 20, 1923, by F. M. Gage. From

the same locality and collected likewise on April 20, 1933, by F. M. Gaige, are specimens of another close relative, *Trigona atomaria* Cockerell.

***Lestrimellita limão* (Smith)**

*Trigona Limão* SMITH, 1863, Trans. Ent. Soc. London, (3) I, p. 506.

*Lestrimellita limao* RAV, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 32-34.

Specimens were collected Feb. 18, 1929, by C. H. Curran, Nov. 15, 1930, by E. I. Huntington and H. F. Schwarz, Feb. 27, 1933, by H. F. Schwarz.

All of these specimens, the capture of which extended at intervals over a period of four years, were taken from the same nest. It would be hard to say for how long a time this nest was in existence before its presence became known.

ADDENDUM

***Ceratina mexicana currani*, new name for *Ceratina mexicana zeteki***

In a recently issued paper on 'The solitary bees of Barro Colorado Island, Canal Zone' (1934, Amer. Mus. Novitates, No. 722) I named (p. 10) a new variety (*zeteki*) of *Ceratina mexicana*. Through a strange coincidence Professor T. D. A. Cockerell, wishing likewise to honor Mr. James Zetek, selected that name for yet another species of *Ceratina*, and his paper, published in the May, 1934, issue of the Entomologist, LXVII, p. 107, made its appearance about a week in advance of mine. Thus his *Ceratina zeteki* would seem clearly to have priority. Therefore, I designate the *Ceratina* from Barro Colorado Island *Ceratina mexicana currani* in honor of Dr. C. H. Curran, who collected the type specimen. I am indebted to Professor Cockerell for bringing this inadvertent duplication to my attention.



# AMERICAN MUSEUM NOVITATES

Number 732

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

June 14, 1934

59.57.99 (73 W)

## NEW AND LITTLE-KNOWN WESTERN BEES

By T. D. A. COCKERELL

The species recorded below are of special interest for various reasons. It is astonishing to find a new *Coelioxys* of large size in the vicinity of Boulder. This and other species bred by Mr. Hicks show how it is possible to obtain in this way insects which are rarely found in general collecting. Either they are rare, or their habits are such that they do not easily fall into the net.

The holotypes of all the new species are in The American Museum of Natural History.

### *Andrena scotoptera*, new species

FEMALE.—Length about 12 mm., anterior wing 10; black, with the tarsi more or less brownish; head very broad, orbits slightly diverging below; mandibles ordinary; malar space obsolete; process of labrum large, truncate, not at all emarginate; clypeus shining, but densely and conspicuously punctured, with a smooth median line; antennae rather long for a female, black, third joint almost as long as next two together; facial foveae broad, whitish, separated from eye by a shining band; hair of head and thorax long and abundant, fulvous, becoming rich ferruginous above, and long red hairs at each side of face; mesothorax and scutellum very finely punctured, glistening but not polished; area of metathorax without plicae, almost hidden by long hair; tegulae ferruginous; wings fuliginous, the apical margin not darker than the rest; stigma rather large, very dark reddish, hard to see in the dark wing; nervures light brown; basal nervure meeting nervulus; second cubital cell very large, quadrate, receiving recurrent nervure slightly beyond middle; legs with yellowish hair, the scopa of hind tibia entirely pale, tuft on hind knees very light reddish brown, hair on inner side of hind basitarsi light reddish fulvous; spurs pale reddish; abdomen above somewhat shining, but not polished, without bands, the depressions dullish, not shining; tergites extremely finely and closely punctured, the punctures just visible under a hand lens; second tergite in middle depressed more than a third, but much less than a half; caudal tuft clear red; sternites with very long pale fulvous fringes. The dark wings are strongly reddened.

Texas: Austin, March 24, 1933 (H. B. Parks, Jr.). Taken on willow. Received from Mr. H. B. Parks. Closely allied to *A. perplexa* Smith, which has been recorded from Texas, under the name *A. belfragei* Cresson. It is especially to be recognized by the fuliginous wings, those of *A. perplexa* being "subhyaline, their apical margins clouded," or as Cresson states for *A. belfragei*, "yellowish-hyaline, apex rather broadly

fuscous, subviolaceous." It also closely resembles *A. commodu* Smith, the *A. corni* Robertson, but the black antennae, bright red tegulae, somewhat narrower facial foveae, and less shining, not at all pruinose abdomen, are distinctive.

***Protandrena mexicanorum* (Cockerell)**

Colorado: Crowley, Aug. 4, 1933 (Helen James). New to Colorado.

***Emphoropsis birkmanni* Cockerell**

Mr. H. B. Parks has found this species near San Antonio, Texas, and sends the hitherto unknown male, which resembles the female but has the clypeus (except the usual black marks), a narrow stripe along lower edge of supraclypeal area, and lateral face marks, all very pale yellow. There are long black hairs at each side of face. The hair on the legs is black, a little pale at end of middle tibia. The pattern of the face marks is similar to that of *E. floridana* (Smith), but the clypeus is larger and longer.

Mr. Parks gives the following account of the habits of the species:

This is one of the earliest flying of this general group of bees. Its flight seems to be of the same occurrence as the blooming of *Lupinus subcaruosus* Hooker, and *Aesculus pavia* Linnaeus. This period is about six weeks long and varies in the date of beginning from February 20 to March 15. I have never captured a specimen of this bee beyond the limits of the Carrizo sand deposit which crosses the southern boundary of Bexar County. The females collect pollen and nectar from both of the plants named. However, I have never captured a male on *Aesculus*. I have captured males on *Lupinus* and on *Hamosa nuttalliana* (DC) Rydberg. I suspect that more collecting would show that this species frequents all of the flowers blooming at that time which have long corolla tubes. The nests of this insect are tunnels driven into the walls of ravines generally in a place where the wall is protected by an overhanging tree. At the mouth of the tunnels a small tube is built which goes out about one-eighth of an inch and then turns downward some times at least one-half inch. Evidently these insects recognize their own nest from a distance, because when they come in or leave it is extremely hard to capture them. Those leaving can be captured by placing the net over the tunnels but holding the net the other way fails to catch any of the incoming

It will be noted that the nest-building habits are like those of *Anthophora*.

***Coelioxys hicksi*, new species<sup>1</sup>**

FEMALE.—Length about 15 mm., anterior wing 11; entirely black, including mandibles, antennae, tegulae, and legs; eyes very dark green, with very short hair; mandibles tridentate; face with thin whitish hair, forming a very thin pruinose covering on clypeus, from the lower margin of which project orange hairs; long white hair laterad of each antenna; clypeus convex, dullish, very finely sculptured, the lower margin straight and simple; front dull; vertex with very large irregular punctures; mesothorax practically bare, except some pale hair in front, its surface shining but not polished, with very strong well-separated punctures; spines of axillae very short; scutellum with very coarse and dense punctures, the margin broadly rounded; sides of metathorax with abundant pale, slightly tawny hair; mesopleura coarsely punctured, the punctures more or less in rows, and with pale hair; wings grayish hyaline, with a well-defined dusky outer margin; stigma and nervures black; basal nervure meeting nervulus; first recurrent nervure ending far from base of second cubital cell, the distance rather more than half of the length of intercubitus; spurs black; hind basitarsi with pale reddish hair on inner side; abdomen shining, with sparse punctures; first tergite with a large triangular patch of dense white hair on each side; tergites 2 to 4 with pure white hair-bands, broadened at sides, linear and almost evanescent in middle; tergites 2 and 3 with a broad oblique groove on either side of middle, not at all connected across the middle line; sixth tergite shining, with a fine keel running its whole length, at sides it is rather abruptly constricted, the apical portion obtuse and not turned up at end; apical sternite extending considerably beyond the tergite, narrow (but not excessively so), neither notched nor fringed; fourth sternite with rather strong, distinctly separated punctures of about the same size; fifth sternite dullish, without evident punctures, the apex slightly bidentate.

Colorado: Nederland, bred March 31 (in laboratory) from cells of *Megachile sapellonis* Cockerell (Chas. H. Hicks). Related somewhat to *C. alternata* Say, to which it runs nearest in Crawford's table, but easily separated by the large size and the structure of the sixth sternite.

The wood containing the *Megachile* nests was found at Nederland by Mr. W. O. Mitchell.

***Coelioxys rudis*, new species**

FEMALE (type).—Length, 12 mm., or sometimes smaller; black, with the tegulae dark red, tibiae and tarsi bright chestnut-red, basal part of legs black, but femora with the apical half, more or less, red; eyes black, with very short hair; face densely covered with short white hair; clypeus densely and finely punctured, with a very delicate median raised line, lower margin straight and simple; top of head with dense, very coarse punctures all over; mesothorax and scutellum extremely coarsely punctured.

<sup>1</sup>Since this paper was written, Professor Brues has published an interesting discussion on size in insects (Psyche, March, 1934). In the Palaearctic region there occur relatively gigantic forms of *Halictus*, which appear to have arisen by discontinuous variation (mutation). In North America there are certain large species of *Megachile* (*M. cockerelli*, *M. sapellonis*), which possess many distinctive characters other than size. Are we to suppose that *Coelioxys* has or had a tendency to produce large forms, which under ordinary circumstances would not survive, but that the existence of the large *M. sapellonis* made possible the establishment of a large type of *Coelioxys*? A detailed consideration of the size factor among bees would certainly give interesting results, but it would doubtless be found that various influences were involved, no simple or single explanation being sufficient.

tured; axillar spines long; anterior margin of mesothorax with white hair, failing in middle; a tuft of pure white hair in front of base of each axilla, and two transverse spots of white hair between mesothorax and scutellum; sides of thorax posteriorly with much white hair; wings hyaline, with the apical margin broadly clouded; second cubital cell receiving first recurrent nervure about twice as far from base as second from apex; front femora with a rather short, even fringe of white hair behind; abdomen shining, the punctures distinct but not dense; first tergite with a shining impunctate band subapically; second tergite with a complete deep transverse channel; margins of tergites 1 to 5 with even, pure white hair-bands; sixth tergite swollen basally but evenly rounded, finely punctured, with an obscure median raised line, the apical part narrowed, not upturned at tip; sixth sternite extending far beyond sixth tergite, long and narrow, not notched at sides, and not fringed.

MALE.—Length about 10 mm.; face and front densely covered with long, pure white hair; eyes black; second cubital cell receiving recurrent nervures equally distant from base and apex; front coxae with strong spines; tergites with white hair-bands, on fourth and fifth weak or failing in middle, but fifth and sixth with broad basal bands, narrowly interrupted in middle; fifth with a strong spine at each side; sixth with strong sharp lateral spines, and four apical ones, the upper pair rather short, and divergent; sixth segment short; the second tergite has a pair of linear transverse foveae, the surface behind and mesad of each fovea brilliantly polished; third sternite pale reddish at extreme base.

Colorado: vicinity of Boulder, reared by Mr. Chas. Hicks, from nests of *Megachile montivaga* Cresson. The exact localities are Owen's Lake, near Marshall and near Lake View.

Through some confusion that I cannot now explain, this was referred to *C. coloradensis* Cresson, which was based on a male with polished black tegulae, black legs with red tarsi, and differently ornamented abdomen. In Crawford's table the female goes exactly to *C. sculptifrons* Crawford, but is distinguished by the long axillar spines, conspicuous pubescence covering clypeus, and other characters. It is less robust than *C. deplanata* Cresson, and has the end of the female abdomen very much narrower. The hair on the eyes is much shorter than in *C. rufitarsis* Smith.

#### *Ashmeadiella coloradensis*, new species

MALE.—Length about 5 mm.; black, including mandibles, antennae (flagellum very faintly reddish beneath), eyes, tegulae, and apical teeth of abdomen; first tergite clear red, blackened at extreme base, and with a black stain at apical middle, second tergite broadly red at sides, third with a little red laterally; hind femora red, black at apex-above; hind tibiae red, with the hind margin and apex black, the margin with dense white hair; face and front entirely covered with long pure white hair; thorax with white hair, on mesopleura densely covering the surface; abdomen with conspicuous white hair-bands, on bases and apices of tergites; venter with broad bands of white hair; vertex dullish, very densely punctured; mesothorax finely and closely punctured, moderately shining on disc; scutellum shining; scutellar

region with long hair; extreme base of metathorax dull, but this is followed by a brilliantly shining band; hair on inner side of hind basitarsi pale orange; abdomen shining, with the usual four apical teeth, the middle pair short and broad, obtusely pyramidal in outline; stipites reddish, stout, strongly curved, covered with fine short pubescence. The maxillary palpi are very short. The wings are perfectly hyaline, and iridescent, the nervures very delicate, except that the intercubiti are stout. The second recurrent nervure reaches second cubital cell at a distance from base equal to a little over half of the length of first intercubitus.

From the same lot of nests, Mr. Hicks bred several specimens which had the tegument of legs and abdomen entirely black. It does not appear possible that these represent another species.

The species is nearest to *A. prosopidis* Cockerell, which is black, and distinctly smaller, with very slender abdominal bands. It may be only racially distinct, but I have no topotypical males of *A. prosopidis* to dissect.

From *A. wislizeni* Cockerell (male), *A. coloradensis* differs by being smaller, with the middle teeth of apex of abdomen obtusely pyramidal, instead of being like the end of a finger. A more easily noticed character for separation is the dense covering of white hair on mesopleura.

Colorado: Owen's Lake, near Boulder, bred in some numbers by Mr. Charles Hicks. He will later publish his observations.

#### ***Osmia mertensiae* Cockerell**

This was described (1907) from the male, taken at Florissant, Colorado. The female is olive green, with black ventral scopa; head large, with broad rounded cheeks; mandibles broad, with three teeth, the two outer sharp, the third broad and strongly emarginate, so that it may be regarded as two teeth; clypeus normal, dull and granular, the pubescence abundant, appearing white in lateral view, but gray and inconspicuous from the front; below the margin of the clypeus are two large tufts of orange hair; sides of face and supraclypeal area glistening; antennae black, the flagellum obscurely reddish beneath (not conspicuously red as in the male); vertex and middle of front with conspicuous long black hair, occiput with white hair; thorax with long silky white hairs, but mixed with long black hairs on disc (in the male these black hairs are wholly absent); base of metathorax glistening but not polished, golden green, contrasting with the blue-green of the parts immediately below; legs black; spurs black; hair on inner side of hind basitarsi chocolate color; abdomen shining, hind margins of tergites more golden green than the rest; first tergite with long silky white hair, but the apical middle tergites with very scanty black hair; sixth with some pale pubescence.



In my table in University of Colorado Studies, XVI (1928), the female runs to the vicinity of *O. olivacea* Cockerell, but it is considerably smaller, with more shining abdomen. On account of the smaller size, it can be run to *O. albolateralis* Cockerell, which lacks the large orange tufts below the clypeal margin, has conspicuous black hair at sides of clypeus, and is differently colored. In the Sandhouse key to Pacific coast species (1924, Proc. Calif. Acad. Sci., XIII) it runs out next to the blue-green *O. sedula* Sandhouse. In the Sandhouse key to Canadian species (1925, Canad. Entom., LVII), it runs nearest to *O. phaceliae* Cockerell, which is blue, with a much narrower abdomen.

*O. mertensiae* is widely distributed, and I expected to find that the female had been described under another name, but this is not the case. Both sexes were bred from the nest by Mr. Charles H. Hicks, April 18, 1934. The nests were found at Nederland, Colorado (alt. 8260 ft.), by the little son of Mr. W. O. Mitchell, who gave them to Mrs. Helen James.

#### *Alcidamea helenae*, new species

MALE.—Length about 7 mm.; resembles *A. mucronata* Ckll. in the fulvous hair of head and thorax above, but easily distinguished by the smaller size, the whiter hair of face (though it is not pure white, like that on lower part of mesopleurs), the basal nervure falling a little short of intercubitus, the shorter apical spine of abdomen, and especially the produced and acute ventral spine. Structurally it is more like *A. producta* Cresson, but it is larger, with differently colored pubescence. The marginal cell is considerably longer and more slender than in a drawing of the wing of the type of *A. producta*, kindly made for me by Mr. E. T. Cresson, Jr.

Colorado: Gregory Canyon, Boulder, bred from a twig, May 5, 1934 (Helen James). From the same twig was bred a female parasite, *Stelis sexmaculata* Ashmead.





# AMERICAN MUSEUM NOVITATES

Number 733

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

July 19, 1934

59.81 (51)

## LIST OF CHINESE TURTLES, CROCODILIANS, AND SNAKES, WITH KEYS<sup>1</sup>

By CLIFFORD H. POPE

The contents of this paper have been taken from the completed manuscript of a work by me on the reptiles of China, which is to appear soon as volume X of 'The Natural History of Central Asia,' a series of twelve volumes now in course of preparation and publication by the American Museum. The vast material collected in China and Mongolia by members of the Central Asiatic Expeditions, under the leadership of Roy Chapman Andrews, forms the basis of these volumes.

The object of this paper is to present a list, together with means of identification, of all the valid forms of turtles, crocodilians, and snakes known with certainty to inhabit China northward to a line connecting the head of the Liaotung Gulf with the northernmost point of Kansu, and westward as far as the western boundaries of Chinghai and Hsi-kang. Keys for identification of all listed forms are included. Many of these keys, especially the longer ones, are entirely new.

The numerous differences between the present list and the one published by Mell in 1931 (*Lingnan Sci. Jour.*, VIII, pp. 199-219) are due largely to my more conservative attitude in regard to the recognition of subspecies. Also, I hold that a subspecies is a form that has been shown to intergrade with another form.

The following points, arranged in three groups for convenience of reference, must be remembered in using the list and keys.

1.—Only the Chinese distribution of each form is given. Those forms known to occur only within the limits of China as outlined above are marked with an asterisk. Although listed occasionally, Hongkong is not considered a part of China.

2.—A rather wide distribution within a province is indicated when no specific localities are given. If no specific record exists for a province, the name of the province is followed by the abbreviated phrase "no loc." in parentheses. Due to its peculiar shape, sections of Szechwan are not easily designated by the use of the points of the compass; therefore, in some cases, the mention of Szechwan alone does not imply a distribution over the entire province.

3.—Only well-authenticated locality records are included.

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 127.

4.—The keys are specifically constructed for the identification of material from China as already delimited and should not be fully depended upon for specimens from adjacent regions.

5.—All available literature published previous to January 1, 1934, has been included as well as a few papers dated 1934.

**TURTLES** (key p. 14)

**DERMOCHELIDAE**

**DERMOCHELYS** Blainville

*Dermochelys coriacea* (Linnaeus).

Amoy.

**CHELONIIDAE** (key p. 15)

**ERETMOCHELYS** Fitzinger

*Eretmochelys imbricata* (Linnaeus).

Hainan region.

**CHELONIA** Latreille

*Chelonia mydas* (Linnaeus).

Islands near Hongkong.

**CARETTA** Rafinesque

*Caretta caretta olivacea* (Eschscholtz).

Hwangpu; between Four Sisters and Two Brothers Islands, east of Chusan.

**PLATYSTERNIDAE**

**PLATYSTERNON** Gray

*Platysternon megacephalum* Gray.

Kwangtung and Kwangsi; north. along coast to region of Foochow.

**TESTUDINIDAE** (key p. 15)

**CYCLEMYS** Bell (key p. 15)

\**Cyclemys flavomarginata sinensis* Hsü.

Chunshan in Tungting Lake.

*Cyclemys mouhotii* Gray.

Namfong on Hainan.

\**Cyclemys trifasciata* (Bell).

Southern Kwangtung; Shihwantashan in southwestern Kwangsi.

\**Cyclemys yunnanensis* Boulenger.

Yunnanfu and Tungchwan in Yunnan.

**GEOEMYDA** Gray

*Geomyda spengleri spengleri* (Gmelin).

Kwangtung (no loc.); Kwangsi.

**CLEMMYS** Ritgen (key p. 16)

**\*Clemmys bealei** (Gray).

Futsing Hsien and region of Foochow in Fukien.

**Clemmys mutica** (Cantor).

Kunshan in Kiangsu; Ningpo and Chusan in Chekiang; Ningkwo in Anhwei; Hainan.

**\*Clemmys nigricans** (Gray).

Southern China, probably Kwangtung.

**Clemmys quadriocellata** Siebenrock.

Lofaoshan, Hsiaokeng and Hainan in Kwangtung; Lohsiang and Shihwantashan in Kwangsi.

**GEOCLEMMYS** Gray (key p. 16)

**\*Geoclemmys kwangtungensis** Pope.

Hsiaokeng, Lofaoshan and Tinghushan in Kwangtung.

**Geoclemmys reevesii** (Gray).

Widely distributed in China where it is frequently transported by human agencies.

**OCADIA** Gray

**Ocadia sinensis** (Gray).

Hainan and mountains east of Shiuchow in Kwangtung; other somewhat uncertain records for more northern localities.

**PSEUDOCADIA** Lindholm

**\*Pseudocadia anyangensis** (Ping).

Ancient ruins of Anyang Hsien in Honan; apparently extinct.

**TESTUDO** Linnaeus

**Testudo elongata** Blyth.

Living specimen purchased from a village near Nanning in Kwangsi.

**TRIONYCHIDAE** (key p. 16)

**PELOCHELYS** Gray

**Pelochelys bibroni** (Owen).

Region of Nodoa on Hainan; Foochow; repeatedly observed for sale in Canton market.

**AMYDA** Oken (key p. 16)

**Amyda sinensis** (Wiegmann).

Widely distributed in China.

**Amyda steindachneri** (Siebenrock).

Kwangtung (no loc.); Kwangsi; probably Kweichow.

## CROCODILIANS

**ALLIGATORIDAE****ALLIGATOR** Cuvier

\***Alligator sinensis** Fauvel.

Lower Yangtze Valley, chiefly in the region of Wuhu and Taihu.

## SNAKES (key p. 16)

**TYPHLOPIDAE****TYPHLOPS** Oppel

**Typhlops braminus** (Daudin).

Kwangtung; northward from Kwangtung to Changning and Nanan, in southern Kiangsi, and Foochow and Yenping in Fukien.

**BOIDAE** (key p. 17)**PYTHON** Daudin

**Python molurus bivittatus** Schlegel.

Yuankiang in southern Yunnan; Kwangtung; Yenping in Fukien.

**ERYX** Daudin

**Eryx miliaris roborowskii** Bedriaga.

Sachow in Kansu; Edsin gol and fifty-five miles northwest of Ningsia in Ningsia.

**XENOPELTIDAE****XENOPELTIS** Reinwardt

**Xenopeltis unicolor** Reinwardt.

Wuyung in Kwangtung.

**COLUBRIDAE** (key p. 17)**Colubrinae** (key p. 18)**SIBYNOPHIS** Fitzinger (key p. 20)

**Sibynophis chinensis** (Guenther).

Widely distributed in southern and central China; no record for Yunnan.

**Sibynophis collaris** (Gray).

Husa Valley in extreme western Yunnan.

\***Sibynophis grahami** (Boulenger).

Yunnanfu, between Yunnanfu and Kutsing, and Wutingchow in Yunnan.

**Natrix** Laurenti (key p. 20)**\*Natrix aequifasciata** Barbour.

Lohsiang in eastern Kwangsi; Kwangtung; Futsing Hsien, Foochow and Yenping in Fukien.

**Natrix annularis** (Hallowell).

Northern Fukien; northern and eastern Kiangsi; southern Anhwei; southern Kiangsu; Chekiang.

**Natrix bitaeniata** Wall.

Extreme western Yunnan.

**Natrix chrysarga** (Schlegel).

Hainan.

**\*Natrix craspedogaster** (Boulenger).

Eastern central China south of the Yangtze River; from Yachow southeastward to the Yunnan border south of Süchow in Szechwan.

**\*Natrix johannis** (Boulenger).

Wutingchow region and Yunnanfu in Yunnan; Luningying ( $28^{\circ} 27' \times 101^{\circ} 43'$ ) and Omei Hsien in Szechwan.

**Natrix nuchalis** (Boulenger).

Northern Yunnan; Chiulung Hsien in Hsikang; Muping region, Washan region, Mt. Omei and Süchow in Szechwan; Ichang in Hupeh.

**\*Natrix octolineata** (Boulenger).

Central and northern Yunnan; southern Szechwan.

**\*Natrix ornateps** (Werner).

Hainan; Lohsiang in eastern Kwangsi.

**Natrix percarinata** (Boulenger).

Southern and central China, south of the Yangtze in the east; Szechwan.

**Natrix piscator** (Schneider).

Widely distributed in extreme southern China, extending its range northward in the east to Wenchow in Chekiang and Hokow in northeastern Kiangsi.

**\*Natrix popei** Schmidt.

Lohsiang in eastern Kwangsi; Linping and Hainan in Kwangtung.

**Natrix sauteri** (Boulenger).

Lohsiang in eastern Kwangsi; Linping in northern Kwangtung; southern Fukien; Chouchiakou (southeast of Süchow) in Szechwan.

**Natrix stolata** (Linnaeus).

Widely distributed in extreme southern China, extending its range northward in the east to Tunghu and the Chusan Islands in Chekiang and Hokow in northeastern Kiangsi; extreme western Yunnan.



*Natrix subminiata subminiata* (Schlegel) (see key p. 22).

Hainan.

*Natrix subminiata helleri* Schmidt.

Yenping in Fukien; Kwangtung; Lohsiang in Kwangsi; Hwangtsaopa in southwestern Kweichow; northern and extreme western Yunnan.

*Natrix tigrina lateralis* (Berthold).

Widely distributed in central and northern China.

**PSEUDOXENODON** Boulenger (key p. 22)

\**Pseudoxenodon bambusicola* Vogt.

Hainan and northern Kwangtung; Lohsiang in eastern Kwangsi; Futsing Hsien and Yenping in Fukien.

\**Pseudoxenodon dorsalis* (Guenther).

Chekiang (no loc.).

\**Pseudoxenodon fukienensis* Pope.

Chungan Hsien in northwestern Fukien.

\**Pseudoxenodon karlschmidtii karlschmidtii* Pope (see key p. 23)

Chungan Hsien and Yenping in Fukien.

\**Pseudoxenodon karlschmidtii sinii* Fan.

Yaoshan in eastern Kwangsi; Kwangtung.

*Pseudoxenodon macrops macrops* (Blyth) (see key p. 23).

Eastern Hsikang; western and probably southern Yunnan.

\**Pseudoxenodon macrops sinensis* Boulenger.

Southwestern Szechwan; Yunnan plateau.

\**Pseudoxenodon striaticaudatus* Pope.

Chungan Hsien in northwestern Fukien.

**HELICOPS** Wagler

\**Helicops yunnanensis* (Anderson).

Extreme western Yunnan.

**MACROPISTHODON** Boulenger

*Macropisthodon rudis* Boulenger.

Foochow and Chungan Hsien in northern Fukien; northern Yunnan; ascent from Yen Yuan to Santashan in southwestern Szechwan.

**OPISTHOTROPIS** Guenther (key p. 23)

*Opisthotropis andersonii* (Boulenger).

Hongkong.

*Opisthotropis balteata* (Cope).

Hainan and Wyung (east of Canton) in Kwangtung; Lohsiang in eastern Kwangsi.

**\*Opisthotropis kuatunensis** Pope.

Chungan Hsien in northwestern Fukien.

**Opisthotropis lateralis** Boulenger.

Yaoshan in eastern Kwangsi.

**\*Opisthotropis latouchii** (Boulenger).

Extreme northern Kwangtung; from Futsing Hsien to Chungan Hsien in Fukien; Pingsiang in Kiangsi.

**\*Opisthotropis maxwelli** Boulenger.

Southern Fukien.

#### **RHABDOPS** Boulenger

**Rhabdops bicolor** (Blyth).

Chanta Valley in extreme western Yunnan.

#### **TRIRHINOPHOLIS** Boulenger

**\*Trirhinopholis styani** Boulenger.

Chungan Hsien in Fukien; Mokanshan in northern Chekiang; Wangwanshan in southeastern Anhwei; Kuling in northern Kiangsi; Mt. Omei in Szechwan.

#### **ACHALINUS** Peters (key p. 23)

**Achalinus rufescens** Boulenger.

Namkao (Hainan) and between Linping and Chungsun in Kwangtung; Lohsiang in eastern Kwangsi; Fukien (no loc.).

**Achalinus spinalis** Peters.

Eastern Chekiang; Chungan Hsien in Fukien; northern and eastern Kiangsi; Nanking in Kiangsu; Ichang in Hupeh; Chouchiakou, Süchow, Mt. Omei and Washan in Szechwan.

#### **LYCODON** Boie (key p. 24)

**Lycodon aulicus aulicus** (Linnaeus).

Amoy; Pangsí in extreme western Yunnan.

**Lycodon fasciatus** (Anderson).

Northern and extreme western Yunnan; Ningyuan in southwestern Szechwan.

**Lycodon ruhstrati** (Fischer).

Huangchiakou (southeast of Süchow) and Mt. Omei in Szechwan; the Lushan in Kiangsi; Chungan Hsien and Futsing Hsien in Fukien; Lungtöu in northern Kwangtung.

**Lycodon subcinctus** Boie.

Hainan and Foochow.

**DINODON** Duméril (key p. 24).**\*Dinodon flavozonatum** Pope.

Chungan Hsien in Fukien; between Linping and Chunghsin in northern Kwangtung.

**Dinodon rufozonatum** (Cantor).

Widely distributed in northern and central China.

**ZAOCYS** Cope (key p. 24)**\*Zaocys dhumnales dhumnales** (Cantor) (see key p. 24).

Plains and lower mountains of central China.

**Zaocys dhumnales montanus** Pope.

Higher mountains of central and southern China.

**Zaocys nigromarginatus** (Blyth).

Ningyuan and Lushuiho in southwestern Szechwan; Tengyueh, twenty miles north of Yunnanfu and Yunnanfu in Yunnan.

**PTYAS** Fitzinger (key p. 24)**Ptyas korros** (Schlegel).

Tunglu and Taichow in Chekiang; Hokow and Kiukiang in Kiangsi; Fukien; Kwangtung; Yaoshan in Kwangsi; Hsikwangshan in Hunan; Yuankiang and Chanta and Husa Valleys in Yunnan.

**Ptyas mucosus** (Linnaeus).

Taichow and Wenchow in Chekiang; Ichang in Hupeh; Hokow in Kiangsi; Fukien; Kwangtung; Yaoshan in Kwangsi; Tengyueh in Yunnan; Batang in Hsikang.

**COLUBER** Linnaeus**Coluber spinalis** (Peters).

Widely distributed in northern China.

**ELAPHE** Fitzinger (key p. 24)**\*Elaphe bimaculata** Schmidt.

From Hankow eastward to Hangchow and Chinkiang.

**Elaphe carinata** (Guenther).

Widely distributed in central China.

**Elaphe davidi** (Sauvage).

Chihfeng in Jehol; the Tungling near Moukden.

**Elaphe dione** (Pallas).

Widely distributed over northern China; Shanghai.

***Elaphe frenata* (Gray).**

Chungan Hsien and Yenping in Fukien; Chayuanshan and Lungtoui in northern Kwangtung.

***Elaphe mandarinus* (Cantor).**

Chekiang; Chungan Hsien in Fukien; Wanszushan in northern Kwangtung; Kweichow (no loc.); Szechwan.

***Elaphe moellendorffi* (Boettger).**

Nanning in Kwangsi; Canton, Wuyung and Namkong (east of Canton) in Kwangtung.

**\**Elaphe perlacea* Stejneger.**

Yachow Prefecture in Szechwan.

***Elaphe porphyracea porphyracea* (Cantor) (see key p. 26).**

Opiein Hsien in Szechwan; north central and extreme western Yunnan.

***Elaphe porphyracea nigrofasciata* (Cantor).**

Hainan, Lofaoshan and Lungtoui in Kwangtung; Lohsiang in eastern Kwangsi; Fukien; Ningpo region in Chekiang.

***Elaphe prasina* (Blyth).**

Pupiao, Imen Hsien and Wutingchow in Yunnan.

***Elaphe radiata* (Schlegel).**

Southern Fukien; regions east and west of Canton in Kwangtung; Lohsiang in eastern Kwangsi; Yuankiang in southern Yunnan.

***Elaphe rufodorsata* (Cantor).**

Central China east of Hankow and north of northern Fukien; northeastern China.

***Elaphe schrenckii anomala* (Boulenger).**

Chihfeng in Jehol; Hsinglungshan, Peiping and the Western Hills in Hopei; Hululi (sixty-five miles southwest of Taiyuan) in Shansi; Tsingtao in Shantung.

***Elaphe taeniurus* Cope.**

Widely distributed through southern, central and northeastern China.

**RYNCHOPHIS Mocquard**

***Rhynchophis boulengeri* Mocquard.**

Yaoshan in eastern Kwangsi.

**DENDROPHIS Fitzinger**

***Dendrophis boiga boiga* (Lacépède).**

Hainan; Lungling in western Yunnan.

**EURYPHOLIS** Hallowell (key p. 26)

**Eurypholis doriae** (Boulenger).

Hokow in southeastern Yunnan.

**Eurypholis major** (Guenther).

Central and southeastern China, south of the Yangtze River in the east.

**Eurypholis multicinctus** (Roux).

Lohsiang in eastern Kwangsi.

**CORONELLA** Laurenti

\***Coronella bella** Stanley.

Kuatun in northwestern Fukien.

**HOLARCHUS** Cope (key p. 26)

**Holarchus chinensis** (Guenther).

From Lohsiang in Kwangsi northeastward to Nanking and Kiangyin in Kiangsu; Yunnanfu.

**Holarchus formosanus** (Guenther).

Wenchow in Chekiang; Hokow and Nanchang in Kiangsi; Fukien; Kwangtung; Yaoshan in eastern Kwangsi.

**Holarchus violaceus** (Cantor).

Southeastern coastal region as far north as Spider Island, Foochow and Yenping in Fukien.

**OLIGODON** Boie (key p. 26)

**Oligodon eberhardti** Pellegrin.

Lohsiang in eastern Kwangsi.

\***Oligodon ornatus musyi** (Roux).

Chungan Hsien in northwestern Fukien.

**CALAMARIA** Boie (key p. 26)

**Calamaria pavimentata** ~~pavimentata~~ Duméril and Bibron.

Lungan and Muping in Szechwan; Lohsiang in eastern Kwangsi; Canton region.

**Calamaria septentrionalis** Boulenger.

Southeastern China north to the Yangtze.

**Homalopsinae****ENHYDRIS** Latreille (key p. 26)

**Enhydris bennettii** (Gray).

Hainan.

**Enhydris chinensis** (Gray).

Ichang in Hupeh; Nanking in Kiangsu; Wenchow in Chekiang; Hokow and Changning in Kiangsi; Fukien; Kwangtung.

**Enhydris enhydris** (Schneider).

No definite Chinese locality known; Hongkong.

**Enhydris plumbea** (Boie).

Wenchow in Chekiang; Fukien; Kwangtung.

**Boiginae** (key p. 27)

**CHRYSOPELEA** Boie

**Chrysopelea ornata** (Shaw).

Fukien (no loc.).

**TAPHROMETOPON** Brandt

**Taphrometopon lineolatum** (Brandt).

Sachow in Kansu; Ningsia region and Alashan in Ningsia.

**AHAETULLA** Link

**Ahaetulla prasina** (Boie).

Hokow in southeastern Yunnan; Yaoshan in eastern Kwangsi; Lofaoshan in Kwangtung.

**PSAMMODYNASTES** Guenther

**Psammodynastes pulverulentus** (Boie).

Fukien; Kwangtung; Yaoshan in eastern Kwangsi; Wutingchow in Yunnan.

**BOIGA** Fitzinger (key p. 27)

**Boiga kraepelini** Stejneger.

Yaoshan in eastern Kwangsi; Yuanshan in northeastern Kiangsi; Chungan Hsien and Futsing Hsien in Fukien; Süchow in Szechwan.

**Boiga multomaculata** (Boie).

Lohsiang in eastern Kwangsi; Kwangtung; Changning in southern Kiangsi; Futsing Hsien in Fukien.

**ELAPIDAE** (key p. 27)

**BUNGARUS** Daudin (key p. 27)

**Bungarus fasciatus** (Schneider).

Fukien (no loc.); Kwangtung; Lohsiang in eastern Kwangsi; Kutung and Hokow ( $28^{\circ} 15' \times 117^{\circ} 41'$ ) in Yunnan.

**Bungarus multicinctus multicinctus** Blyth (see key p. 27).

Southeastern China; eastern central China north to the Yangtze River.

**Bungarus multicinctus wanghaotingi** Pope.

Yuankiang in southern Yunnan.

**CALLIOPHIS** Gray

**Calliophis maclellandi** (Reinhardt).

Lushan and Pingsiang in Kiangsi; Chungan Hsien in northwestern Fukien; Kwangtung; Lohsiang in eastern Kwangsi.

**HEMIBUNGARUS** Peters

\***Hemibungarus kelloggi** Pope.

Chungan Hsien, Yenping, and Futsing Hsien in Fukien; Lohsiang in Kwangsi.

**NAJA** Laurenti (key p. 27)

**Naja hannah** (Cantor).

Foochow region; Kwangtung; Lohsiang in eastern Kwangsi.

**Naja naja atra** Cantor.

Chekiang; Kiukiang, and Hokow in northern Kiangsi; Fukien; southwestern Hunan; Lohsiang in eastern Kwangsi; Kwangtung.

**HYDROPHIIDAE** (key p. 28)

**THALASSOPHINA** Smith

**Thalassophina viperina** (Schmidt).

Hainan and Swatow in Kwangtung.

**HYDROPHIS** Latreille (key p. 28)

**Hydrophis caeruleus** (Shaw).

Tsingtao in Shantung; Swatow in Kwangtung.

**Hydrophis cyanocinctus** Daudin.

Hoihow and Hainan Strait; Foochow; Yenting in Chekiang; Shanghai.

**Hydrophis melanocephalus** Gray.

Wenchow in Chekiang.

**Hydrophis ornatus ornatus** (Gray).

Tsingtao in Shantung.

**LAPEMIS** Gray

**Lapemis hardwickii** Gray.

Tsingtao in Shantung.

**PELAMYDRUS** Stejneger

**Pelamydrus platurus** (Linnaeus).

Hoihow and Swatow in Kwangtung.

**MICROCEPHALOPHIS** Lesson

**Microcephalophis gracilis gracilis** (Shaw).

Hainan region.

**AMBLYCEPHALIDAE**

**AMBLYCEPHALUS** Kuhl (key p. 28)

\***Amblycephalus boulengeri** Angel.

Kweichow (no loc.); Wanhsien region in eastern Szechwan.

\***Amblycephalus chinensis** Barbour.

Szechwan.

\***Amblycephalus kuangtungensis** Vogt.

Chungan Hsien in northwestern Fukien; Lofaoshan and Lungtou in Kwangtung; Lohsiang in eastern Kwangsi.

**Amblycephalus moellendorffi** (Boettger).

Hainan and Lofaoshan in Kwangtung; Lohsiang in eastern Kwangsi.

\***Amblycephalus niger** Pope.

Yunnanfu.

\***Amblycephalus stanleyi** Boulenger.

Chungan Hsien in northwestern Fukien.

**Amblycephalus tonkinensis** Angel.

Hainan.

\***Amblycephalus yunnanensis** Vogt.

Tali region in Yunnan.

**VIPERIDAE** (key p. 29)

**AZEMIOPS** Boulenger

**Azemius feae** Boulenger.

Yenchinghsi (Opie Hsien) and Chouchiakou (southeast of Szechow) in Szechwan; Pingsiang in Kiangsi.

**VIPERA** Laurenti

**Viperi russelii siamensis** Smith.

Wuyung and Namkong (both east of Canton) in Kwangtung.

**CROTALIDAE** (key p. 29)

**AGKISTRODON** Beauvois (key p. 29)

**Agkistrodon acutus** (Guenther).

Ichang and Wusüeh in Hupeh; Shenchow in Hunan; Mokanshan in Chekiang; Chungan Hsien in Fukien; northern Kwangtung.

**Agkistrodon halys** (Pallas).

Widely distributed in northern and central China.



**\*Agkistrodon monticola** Werner.

Mountains just north and slightly west of Likiang in Yunnan.

**\*Agkistrodon strauchi** (Bedriaga).

Hsikang; Sungpan in northwestern Szechwan.

**TRIMERESURUS** Lacépède (key p. 29)**Trimeresurus albolabris** Gray.

Fukien; Kwangtung; Yaoshan in eastern Kwangsi.

**Trimeresurus jerdonii** Guenther.

Northern Yunnan; Szechwan; Ichang in Hupeh.

**Trimeresurus monticola** Guenther.

Tali region and Husa in Yunnan; Szechwan; Chekiang (no loc.); Chungan Hsien and Shaowu in northwestern Fukien.

**Trimeresurus mucrosquamatus** (Cantor).

Fukien; northern Kwangtung; Yaoshan in eastern Kwangsi; Szechwan.

**Trimeresurus stejnegeri stejnegeri** Schmidt (see key p. 29).

Yaoshan in eastern Kwangsi; Hainan and northern Kwangtung; Fukien; Tunglu, Mokanshan and the Ningpo region in Chekiang; Taolin (near Changsha) in Hunan.

**Trimeresurus stejnegeri yunnanensis** Schmidt.

Yunnanfu, Luchuan, Tali, and Tengyueh in Yunnan.

## KEYS FOR IDENTIFICATION

**TESTUDINATA**

- I.—Limbs clawless; carapace with seven prominent, longitudinal ridges; size gigantic; marine.....DERMOCHELIDAE.
- II.—Limbs with one or more claws; carapace without seven longitudinal ridges.
  - A.—Shell covered with horny shields.
    - 1.—Digits not distinct; limbs paddle-shaped with one or two claws; size large; marine.....CHELONIDAE.
    - 2.—Limbs not paddle-shaped; digits distinct; four or five claws present; not marine.
      - a.—Plastral shields separated from marginals by infra-marginals.....PLATYSTERNIDAE.
      - b.—Inframarginals lacking, plastral shields in contact with marginals.....TESTUDINIDAE.
  - B.—Shell covered with soft skin.....TRIONYCHIDAE.

## CHELONIDAE

- I.—Four pairs of costal shields, the first separated from nuchal by the anterior vertebral.  
 A.—Two pairs of prefrontals; dorsal shields strongly imbricate in early life, becoming juxtaposed with age. . . . . ERETMOCHELYS.  
 B.—A single pair of prefrontals; dorsal shields juxtaposed. . . . . CHELONIA.  
 II.—Five or more pairs of costal shields, the first in contact with nuchal; two pairs of prefrontals; dorsal shields juxtaposed. . . . . CARETTA.

## TESTUDINIDAE

- I.—Limbs more or less flattened; digits webbed; top of head covered anteriorly with undivided skin; costal plates not wedge-shaped with alternating broad and narrow ends.  
 A.—Hexagonal neural plates short-sided behind.  
 1.—Plastron hinged; plastron connected with carapace by a ligament. CYCLEMYS.  
 2.—Plastron not hinged; plastron directly united with carapace. GEOEMYDA.  
 B.—Hexagonal neural plates short-sided in front; plastron not hinged; plastron directly united with carapace.  
 1.—Entoplastron intersected by gularohumeral suture.  
 a.—Alveolar surface of upper jaw without a longitudinal, median ridge.  
 (1)—Top of head covered posteriorly with smooth, undivided skin; alveolar surfaces of jaws narrow. CLEMYS.  
 (2)—Top of head covered posteriorly with small shields or granular skin; alveolar surfaces of jaws broad. GEOCLEMYS.  
 b.—Alveolar surface of upper jaw with a longitudinal, median ridge; top of head covered posteriorly with undivided skin; sides of head with numerous, narrow, longitudinal, yellow stripes. . . . . OCADIA.  
 2.—Entoplastron not intersected by gularohumeral suture; entoplastron broader than long. . . . . PSEUDOCADIA.  
 II.—Limbs more or less cylindrical, the posterior pair club-shaped; digits not webbed; top of head covered anteriorly with shields; costal plates wedge-shaped with alternating broad and narrow ends. . . . . TESTUDO.

## CYCLEMYS

- I.—Carapace strongly tricarinate, flattened between the lateral keels, posterior margin serrated. . . . . mouhotii.  
 II.—Carapace not or only feebly tricarinate, not flattened middorsally, posterior margin not serrated.  
 A.—Plastron rounded or feebly nicked posteriorly. . . . . f. sinensis.  
 B.—Plastron distinctly notched posteriorly.  
 1.—Top of head largely light yellow; plastron black with narrow, yellow margins. . . . . trifasciata.

- 2.—Top of head dark olive margined with yellow; plastron dull yellow save for a large reddish blotch in each shield. . . . . *yunnanensis*.

#### CLEMMYS

- I.—Plastron emarginate posteriorly; top of head with one or two pairs of ocelli situated posteriorly; shell with more or less widely distributed vermiculations, small spots or short streaks.

A.—Save for ocelli, top of head uniform olive or chocolate brown.

*quadriocellata*.

B.—Save for ocelli, top of head grayish olive with black vermiculations.

*bealei*.

- II.—Plastron deeply notched posteriorly; top of head without ocelli; shell without vermiculations, small spots or short streaks.

A.—Chin and throat uniform light yellow. . . . . *mutica*.

B.—Chin and throat yellow with conspicuous black markings and mottling. *nigricans*.

#### GEOCLEMYS

- I.—Carapace tricarinate. . . . . *reevesii*.

- II.—Carapace unicarinate. . . . . *kwangtungensis*.

#### TRIONYCHIDAE

- I.—Orbit nearer to temporal than to nasal fossa; postorbital arch narrower than diameter of orbit; proboscis as long as diameter of orbit. . . . . *AMYDA*.

- II.—Orbit nearer to nasal than to temporal fossa; postorbital arch somewhat broader than diameter of orbit; proboscis very short, not more than half as long as diameter of orbit. . . . . *PELOCHELYS*.

#### AMYDA

- I.—Dorsal disc bordered anteriorly by a row of large tubercles; a conspicuous patch of tubercles on either side of base of neck. . . . . *steindachneri*.

- II.—Dorsal disc not bordered anteriorly by a row of large tubercles; no conspicuous patch of tubercles on either side of base of neck. . . . . *sinensis*.

#### SERPENTES

- I.—No teeth in upper jaw; body covered above and below with nearly uniform, cycloid scales; tail not laterally compressed.

*TYPHLOPIDAE*.

- II.—Teeth present in both jaws.

A.—Maxillary horizontal, not erectile; fangs, if present, short.

1.—Mental groove present.

a.—Maxillary bearing several teeth which are never preceded by fangs.

(1)—Vestiges of hind limbs usually evident as a clawlike spur on either side of belly opposite vent; top of head cov-

ered by numerous, small, irregular  
scales.....BOIDAE.

(2)—No vestiges of hind limbs; top of head  
covered by a few large regular shields.

a'.—Frontal in contact with a large,  
azygous occipital shield; scales in  
15 rows throughout.

XENOPELTIDAE.

b'.—Frontal in contact with a pair of  
symmetrical, broadly contiguous  
parietals.....COLUBRIDAE.

b.—Maxillary always bearing fangs which are never  
preceded by other teeth.

(1)—Tail round.....ELAPIDAE.

(2)—Tail laterally compressed.

HYDROPHIIDAE.

2.—No mental groove; scales in 15 rows throughout.

AMBLYCEPHALIDAE.

B.—Maxillary short, vertically erectile, bearing only long,  
perforated fangs.

1.—No loreal pit.....VIPERIDAE.

2.—Loreal pit present.....CROTALIDAE.

## BOIDAE

I.—Premaxillary toothed; labial pits present.....PYTHON.

II.—Premaxillary toothless; no labial pits.....ERYX.

## COLUBRIDAE

I.—Maxillary teeth not grooved.....COLUBRINAE.

II.—Posterior maxillary teeth grooved.

A.—Nostrils valvular and superior; aquatic.....HOMALOPSINAE.

B.—Nostrils lateral; terrestrial or arboreal.....BOIGINAE.

## Colubrinae

- I.—Snout produced into a pointed appendage covered with small scales.  
 II.—Snout not produced into a pointed appendage covered with small scales.
- A.—Subcaudals entire; postoculars absent.  
 B.—Subcaudals divided; postoculars present.
- 1.—Temporals and internasals present.
    - a.—Scales in an even number of rows.
      - (1)—Two or more rows (except posteriorly in *Ptyas mucosus*).
      - (2)—Loreal single, sometimes absent.
        - a'.—Mid-dorsal scale row enlarged.
        - b'.—Mid-dorsal scale row not enlarged.
        - a''.—Prefrontal entire.
        - b''.—Prefrontal divided.
          - (a)—A single internasal.
          - (b)—Two internasals.
    - (a)—Rostral prominent, the part visible from above generally as great as or greater than its distance from frontal; scales smooth, in 13-19 rows anteriorly, 13-17 posteriorly.
      - (a')—Anal divided; scales in 13-15 rows at mid-body.
      - (b')—Anal entire.
    - (h)—Rostral not prominent, the part visible from above less than its distance from frontal.
      - (a')—Maxillary teeth 36 or more in number, uniform in size; scales smooth, normally in 17 rows throughout.
      - (b')—Maxillary teeth 37 or fewer in number.
        - (a'')—Temporals heavily keeled; scales in 23-25 rows at mid-body, all rows keeled.
        - (b'')—Temporals not keeled.
  - 2.—Temporals present; internasals normally absent only in *Oligodon eberhardi*.
    - a.—Scales in an even number of rows.
    - b.—Scales in an odd number of rows.
      - a'.—Maxillary with one or two toothless spaces, the teeth immediately anterior to the first or only space much larger than those just posterior to it.
      - aa'.—Posterior group of maxillary teeth with three teeth.
      - bb'.—Posterior group of maxillary teeth with two teeth.

anterior; scales smooth, in 17 rows anteriorly, 15 before vent. a conspicuous, black-edged, yellow, mid-dorsal stripe extending from frontal throughout length of body. . . . *COLOR.*

(bb')—Posterior maxillary teeth not longer than anterior; no black-edged, mid-dorsal stripe extending from frontal throughout length of body.

(aa')—Maxillary teeth 9; scales smooth, in 19 rows; ventrals 229, subcaudals 51.

*CORONELLA.*

(bb'')—More than 9 maxillary teeth.

*ELAPHE.*

If this character presents difficulties, a study of the remainder of the key will show that a specimen may be carried to the proper genus by a process of elimination, without determining whether or not it has hypophyses developed posteriorly. In this connection, compare the scale row counts of Chinese *Natrix*, as indicated in the present key, with those of *Elaphe* (p. 24). It should be evident that the scale formulas alone will almost invariably suffice to place a snake in one of the two genera. Geographic probability often serves to carry one over a puzzling section of a key.

bb.—Maxillary without a toothless space preceded by teeth larger than those following it.

aa'.—Scales oblique anteriorly; hemipenis deeply forked.

aa''.—Last two maxillary teeth greatly enlarged; scales keeled, in 17-19 rows at mid-body, 15 before vent; anal divided.

*PSEUDOXENODON.*  
bb''.—Last two maxillary teeth not enlarged; scales in 15 rows throughout; anal entire. . . . . *TARHINOPHOLIS.*

bb'.—Scales not oblique anteriorly.

aa''.—Hypophyses developed throughout vertebral column.<sup>1</sup>

(aa)—A pair of prefrontals and internasals always present; rarely more than 19 rows of scales present anteriorly or fewer than 17 posteriorly. . . . *NATRIX.*

(bb)—Either or both internasal and prefrontal divided into more than two scales. . . . *HELIACOPS.*

bb''.—Hypophyses present only on anterior vertebrae.

(aa)—Scales in 15 rows throughout; body green above and below or green with narrow, dorsal cross-bands present posteriorly. . . . . *EURYTHOLIS.*

(bb)—Scales in more than 15 rows anteriorly.

(aa')—Posterior maxillary teeth longer than

## SIBYNOPHIS

- I.—Ten upper labials, only the very large eighth in contact with the single anterior temporal. . . . . *collaris*.
- II.—Nine upper labials, eighth not very large; two anterior temporals, the lower larger and in contact with the seventh and eighth upper labials, seldom entering labial margin (rarely eight upper labials, the sixth and seventh in contact with the lower anterior temporal).
- A.—Subcaudals 83. . . . . *grahami*.
- B.—Subcaudals 98 or more. . . . . *chinensis*.

## NATRIX

- I.—A conspicuous, light, black-edged, vertical bar extending upward from the mouth immediately behind the eye and another similar one just anterior to the eye; subcaudals 116-121; body and tail long and slender, devoid of encircling bands of color; more than 40 maxillary teeth. . . . . *ornaticeps*.
- II.—Eye not preceded and followed by light, black-edged bars; not more than 100 subcaudals; fewer than 40 maxillary teeth.
- A.—Conspicuous bands usually completely encircling the body, sometimes indistinct or wanting dorsally (and ventrally as well in *percarinata*).
- 1.—Normally not more than one labial entering the eye, all rarely excluded from it by suboculars; maxillary teeth 23-28.
- a.—Bands encircling body 16-21, those on tail 7-12, the former constricted on the flanks and usually double on the back and belly (not double in very young individuals); belly devoid of red; head long, its sides viewed from above nearly straight; labials rarely excluded from eye. . . . . *aequifasciata*.
- b.—Bands encircling body very numerous, more than 30 on body and 14 on tail; belly red between the cross-bands; head moderately long, its sides viewed from above distinctly convex; all labials never excluded from eye. . . . . *annularis*.
- 2.—Two labials entering the eye; no red on belly; body bands, if distinct, at least 30 in number; maxillary teeth 29-32. . . . . *percarinata*.
- B.—Body not encircled by bands.
- 1.—Nuchal groove more or less developed.
- a.—Nuchal groove always well developed; upper labials six or fewer; a single anterior temporal. . . . . *nuchalis*.
- b.—Nuchal groove sometimes only poorly developed; upper labials eight or nine, rarely seven; two anterior temporals. . . . . *subminiata*.
- 2.—Nuchal groove absent (sometimes rudimentary in *tigrina lateralis*).
- a.—A conspicuous, divided or simple, black nuchal bar followed for a considerable distance by black cross-bars or checker spots separated by red interspaces; body otherwise predominantly green, belly green and black; two pre-oculars. . . . . *tigrina lateralis*.

b.—Neck and anterior part of body devoid of conspicuous, black cross-bands or checker spots separated by red interspaces; body nowhere predominantly green.

(1)—Dorsum distinctly lineate throughout, devoid of cross-bars and checkering.

a'.—Scales strongly keeled and distinctly notched at their posterior extremities. . . . *bitaeniata*.

b'.—Scales not strongly keeled, not or scarcely notched at their posterior extremities.

*octolineata*.

(2)—Pattern not distinctly lineate throughout.

a'.—A conspicuous lateral line along the belly formed by a black spot on the end of each ventral; belly immaculate between this line and its fellow; dorsum with no pattern or only a faint one; a whitish area on either side of the neck variable in size and shape, sometimes part of a light, longitudinal stripe and often inconspicuous (in *chrysarga*, lateral, ventral spots may be present but they are seldom evident anteriorly and the belly is often pigmented between them; the dorsum always has a double row of conspicuous, light spots; a light marking, usually in the form of a V with the apex directed posteriorly, is present on the neck).

a".—Ventrals 165-175; subcaudals 85-91.

*johannis*.

b".—Ventrals 157 or fewer.

(a)—Ventrals 138 or more; scales 19-17; five, rarely six lower labials in contact with anterior chin-shields.

*craspedogaster*.

(b)—Ventrals 140 or fewer.

(a')—Upper labials seven; scales in 17 rows throughout.

*sauvteri*.

(b')—Upper labials eight; scales 19-17; four lower labials in contact with anterior chin-shields. . . . *popei*.

b'.—No lateral line along the belly formed by a black spot on the end of each ventral; a conspicuous dorsal pattern.



a".—Internasals broadly truncate anteriorly; a row of small, whitish spots along either side of the back, more or less connected, or even supplanted anteriorly, by black spots; scales heavily keeled, keels being present even on the outermost rows. . . . . *chrysarga*:

b".—Internasals much narrowed anteriorly; back without whitish spots along either side, or, if present, such spots are boldly connected anteriorly by black cross-bands, and posteriorly coalesce to form a longitudinal stripe: scales keeled, but at least one outermost row smooth.

(a)—Anterior temporals normally single; three upper labials normally entering eye; all but outermost row of scales on either side keeled.

*stolata*.

(b)—Anterior temporals normally two; two upper labials normally entering eye; at least two outermost rows of scales on either side smooth.

*piscator*.

### **Natrix subminiata**

I.—Ventrals fewer than 160 . . . . . *s. subminiata*.

II.—Ventrals 160 or more . . . . . *s. helleri*:

### **PSEUDOXENODON**

I.—Light brownish-gray above, body and tail crossed by 15 to 24 conspicuous, black or black and gray bands, the first of which sends a narrow black stripe forward along the neck to the parietals where it joins its fellow of the opposite side.

*bambusicola*.

II.—No conspicuous black cross-bands above; no black stripe extending along the neck to join its fellow on the parietals.

A.—A narrow, mid-dorsal, grayish stripe bordered with black present on the tail and persisting a variable distance anterior to the vent.

*striaticaudatus* or *dorsalis*.<sup>1</sup>

B.—No black-bordered, grayish stripe present on tail.

1.—Snout crossed immediately anterior to the eyes by a black band.

*fukienensis*.

<sup>1</sup>*P. dorsalis* is known from a single specimen. The status of the species is problematical and the characters distinguishing it from *striaticaudatus* too complex to be set forth in a key.

## 2.—Snout not crossed by a black band.

a.—Maxillary teeth 19–22; pattern more or less infused with yellow; a black nuchal spot pointed anteriorly, forked posteriorly usually evident throughout life. . . . . *macrops*.b.—Maxillary teeth 26 or 27; pattern devoid of yellow; a black, anteriorly pointed, posteriorly forked nuchal spot evident only in the young. . . . . *karlschmidti*.**Pseudoxenodon karlschmidti**I.—Ventrals 154 or fewer. . . . . *k. karlschmidti*.II.—Ventrals 153 or more. . . . . *k. sinii*.**Pseudoxenodon macrops**I.—Upper labials eight, rarely seven; ventrals rarely as few as 162. . . . . *m. macrops*.II.—Upper labials seven, rarely eight; ventrals 162 or fewer. . . . . *m. sinensis*.**OPISTHOTROPIS**I.—Upper labials thirteen to sixteen, irregular, many divided horizontally; scales in 19 rows throughout. . . . . *kuatunensis*.

II.—Upper labials not more than eleven, regular, normally not divided horizontally; scales in not more than 17 rows posteriorly.

A.—Scales in 19 rows anteriorly and at mid-body, reduced to 17 posteriorly; body completely encircled by alternate dark and light bands, the former compound dorsally. . . . . *balteata*.

B.—Scales nowhere in more than 17 rows; body not banded.

1.—Ten or eleven upper labials. . . . . *lateralis*.

2.—Seven to nine upper labials.

a.—Seven upper labials, first directed backward to form a broad contact with the posterior half of the nasal, seventh very long. . . . . *maxwelli*.

b.—Eight or nine, rarely seven, upper labials, first vertical, not directed backward, in contact only with anterior part of nasal, last rarely very long.

(1)—Nasal divided below nostril; two or three, rarely one, preoculars (including subpreocular) excluding loreal from eye. . . . . *andersonii*.(2)—Nasal never completely divided below nostril; preoculars usually absent, occasionally one, very rarely two present; loreal generally broadly entering eye. . . . . *latouchii*.**ACHALINUS**I.—Suture between internasals longer than that between prefrontals; 23–25 rows of scales at mid-body. . . . . *rufescens*.II.—Suture between internasals shorter than that between prefrontals; 21–23 rows of scales at mid-body. . . . . *sp*

## LYCODON

- I.—Preocular absent, prefrontal entering eye..... *subcinctus*.  
 II.—Preocular present, prefrontal excluded from eye.  
   A.—Loreal in contact with internasals..... *a. aulicus*.  
   B.—Loreal not in contact with internasals.  
     1.—Loreal nearly always entering eye; preocular usually in contact with frontal; body and tail completely encircled throughout by alternate black and white bands..... *fasciatus*.  
     2.—Loreal seldom entering eye; preocular never in contact with frontal; black bands of body nearly always interrupted on ventrals which are largely white (interruption of black bands more complete anteriorly than posteriorly and more evident in adults than in juveniles)..... *ruhrstrati*.

## DINODON

- I.—Blackish above with red cross-bands; loreal extended backward, usually entering eye; scales smooth or with a few mid-dorsal rows weakly keeled posteriorly; usually 12 maxillary teeth..... *rufozonatum*.  
 II.—Blackish above with yellow cross-bands; loreal seldom extended posteriorly, always excluded from eye; 6 to 9 scale rows more or less distinctly keeled at mid-body; 13 maxillary teeth..... *flavozonatum*.

## ZAOCYS

- I.—Black, longitudinal lines more or less evident throughout length of body..... *dhumnades*.  
 II.—Black, longitudinal lines never present anteriorly, more or less evident posteriorly..... *nigromarginatus*.

*Zaocys dhumnades*

- I.—Subcaudals 124 or fewer..... *d. dhumnades*.  
 II.—Subcaudals usually more, rarely fewer, than 124..... *d. montanus*.

## PTYAS

- I.—Scales in 21 or 19 rows on the neck, 17 at mid-body and 14 before the vent..... *mucosus*.  
 II.—Scales in 17 or 15 rows on the neck, 15 or 13 at mid-body and 11 before the vent..... *korros*.

## ELAPHE

- I.—Dorsum uniform bright green with or without indistinct, lateral, oblique, black lines, or, if not green (juvenile *frenata*), loreal absent; complete scale formula 19-17-15.  
   A.—Loreal present..... *prasina*.  
   B.—Loreal absent..... *frenata*.  
 II.—Dorsum not bright green; loreal present (small, rarely absent, in *mandarinus*); scales in 17 or more rows just before vent.  
   A.—Scales in 19 or 21 rows at and anterior to mid-body, 17 just before vent.

- 1.—Scales smooth; ventrals fewer than 220.
    - a.—Scales in 19 rows at and anterior to mid-body; belly immaculate. . . . . *porphyracea*.
    - b.—Scales in 21 rows at and anterior to mid-body; belly conspicuously spotted with black. . . . . *rufodorsata*.
  - 2.—Scales keeled; ventrals more than 220.
    - a.—Anal entire; eight or nine upper labials. . . . . *radiata*.
    - b.—Anal divided; seven upper labials. . . . . *perlacea*.
- B.—Scales in more than 21 rows either at or anterior to mid-body.
- 1.—Scales smooth; no subpreocular; dorsum gray, gaudily adorned with numerous, rhomboidal saddles each consisting of a yellow center broadly bordered with black which is in turn narrowly margined with yellow. . . . . *mandarinus*.
  - 2.—Scales keeled, or, if smooth, a subpreocular present; dorsum without conspicuous yellow and black rhomboidal saddles.
    - a.—One or two outer scale rows smooth at mid-body, the others strongly keeled.
      - (1)—More than 200 ventrals. . . . . *carinata*.
      - (2)—Fewer than 200 ventrals. . . . . *davidi*.
    - b.—More than two outer scale rows smooth at mid-body, keels, when present, not strongly developed.
      - (1)—Tail with four black and four white longitudinal stripes, one white one mid-dorsal, another mid-ventral. . . . . *taeniurus*.
      - (2)—Tail without four black and four white stripes.
        - a'.—More than 250 ventrals. . . . . *moellendorffi*.
        - b'.—Fewer than 250 ventrals.
          - a''.—Pattern complex in young, rapidly fading with maturity: entirely or almost entirely disappearing anteriorly and reduced to indistinct, double, black blotches posteriorly; postocular stripe solid black in young. . . . . *schrenckii anomala*.
          - b''.—Pattern complex, not changing noticeably with age, always uniform throughout length of body; postocular stripe olive gray with black margins.
            - (a)—Lower labials eight to ten, rarely eleven; both branches of posterior head pattern extending caudad a short distance along neck as two parallel, black-edged stripes; a double row of circular spots along middle of back often connected to form a dumb-

bell pattern; maxillary teeth  
18-20.....*bimaculata*.

- (b)—Lower labials eleven to thirteen, very rarely ten; posterior head pattern ending abruptly on the occiput as two broad, divergent, black-edged spots; middle of back with numerous, narrow, black cross-bands never more than remotely suggesting a dumb-bell pattern; maxillary teeth 15-17.

*dione*.

### **Elaphe porphyracea**

- I.—Longitudinal black lines absent or fragmentary anteriorly.....*p. porphyracea*.  
II.—Longitudinal black lines complete or nearly complete throughout.  
*p. nigrofasciata*.

### **EURYPHOLIS**

- I.—Anal entire; dorsum uniform green.....*doriae*.  
II.—Anal divided.  
A.—Dorsum uniform light green.....*major*.  
B.—Dorsum olive green crossed by numerous narrow, bichromatic bands posteriorly.....*multicinctus*.

### **HOLARCHEUS**

- I.—Scales in 19 rows anteriorly.....*formosanus*.  
II.—Scales in 17, rarely 15, rows anteriorly.  
A.—Ventrums with a double row of distinct black spots; a conspicuous design on head and neck.....*chinensis*.  
B.—Ventrums without black spots; head and neck without design.....*violaceus*.

### **OLIGODON**

- I.—Internasals absent; scales in 13 rows at mid-body.....*eberhardti*.  
II.—Internasals normally present; scales in 15 rows at mid-body.....*ornatus musyi*.

### **CALAMARIA**

- I.—Frontal longer than broad; tail tapering to a point.....*p. pavimentata*.  
II.—Frontal as long as broad; tail blunt.....*septentrionalis*.

### **ENHYDRIS**

- I.—Scales in 19 rows at mid-body; two upper labials entering eye.....*plumbea*.  
II.—Scales in 21-25 rows at mid-body (very rarely 19 in *enhydris*); a single upper labial entering eye.  
A.—Scales in 23 or 25 rows at mid-body.....*chinensis*.  
B.—Scales in 21 rows at mid-body (rarely 23 in *enhydris*).

- 1.—Dorsum grayish olive with two rows of irregular, black spots which may be more or less transversely or longitudinally connected.  
*bennettii*.
- 2.—Dorsum uniform grayish olive or grayish brown with or without two light longitudinal lines. .... *enhydria*.

### Boiginae

- I.—One or more of the middle ungrooved maxillary teeth much enlarged.
  - A.—Scales oblique, mid-dorsal row enlarged; pupil horizontal. .... *Ahaetulla*.
  - B.—Scales not oblique, mid-dorsal row not enlarged.
    - 1.—Anal entire; pupil vertically elliptic. .... *Psammodynastes*.
    - 2.—Anal divided; pupil round. .... *Taphrometopon*.
- II.—None of the middle ungrooved maxillary teeth enlarged.
  - A.—Pupil vertically elliptic; head very distinct from neck. .... *Boiga*.
  - B.—Pupil round; head moderately distinct from neck. .... *Chrysopelea*.

### BOIGA

- I.—Temporals not differentiated, their place occupied by numerous small scales; vertebral scale row not enlarged; anal divided. .... *kraepelini*.
- II.—Temporals well developed, one to three in anterior row; vertebral scale row enlarged; anal entire. .... *multimaculata*.

### ELAPIDAE

- I.—Mid-dorsal scale row enlarged; subcaudals undivided. .... BUNGARUS
- II.—Mid-dorsal scale row not enlarged; all or most of the subcaudals divided.
  - A.—Neck dilatable, surrounded by more scale rows than mid-body; internasal bordering nostril. .... NAJA.
  - B.—Neck not dilatable, not surrounded by more scale rows than mid-body; internasal not bordering nostril.
    - 1.—Fangs followed by one or more small teeth; scales in 15 rows throughout. .... HEMBUNGARUS.
    - 2.—Fangs not followed by small teeth; scales in 13 rows throughout. .... CALLIOPHIS.

### BUNGARUS

- I.—Pattern of black and yellow bands, all of which completely encircle the body; tail blunt. .... *fasciatus*.
- II.—Pattern of black and white bands, the former interrupted on the belly; tail tapering to a point. .... *multicinctus*.

### Bungarus multicinctus

- I.—Light bands on body 31 or more. .... *m. multicinctus*.
- II.—Light bands on body 31 or fewer. .... *m. wanghaotingi*.

### NAJA

- I.—An enlarged pair of contiguous occipital shields; scales in 15 rows at mid-body. .... *hannah*.
- II.—No enlarged contiguous occipital shields; scales in 21 (rarely 19) rows at mid-body. .... *naja atra*.



(2)—Four to 6 maxillary teeth.

a'.—Ventrals 175-180; subcaudals 60-74.

b'.—Ventrals 180-194; subcaudals 72-93.

*chinensis*.*kuangtungensis*.**VIPERIDAE**

- I.—Head covered above with a few large, paired shields; scales of body smooth, in 17 rows..... *AZEMIOPS*.  
 II.—Head covered above with numerous, small scales; scales of body keeled, in more than 17 rows..... *VIPERA*.

**CROTALIDAE**

- I.—Head covered above with a few large, paired shields..... *AGKISTRODON*.  
 II.—Head covered above with numerous, small scales..... *TRIMERESURUS*.

**AGKISTRODON**

- I.—Internasals and rostral produced to form a short, upturned appendage... *acutus*.  
 II.—Internasals and rostral normal.

A.—Scales in 21 or more rows at mid-body.

- 1.—Internasals broader than long, often bandlike; a yellowish stripe beginning on the uppermost postocular and extending rearward nearly always present..... *halys*.  
 2.—Internasals longer than or as long as broad, never bandlike; no yellowish stripe extending rearward from uppermost postocular.  
*strauchi*.

B.—Scales in 19 rows at mid-body; no yellowish stripe extending rearward from uppermost postocular..... *monticola*.**TRIMERESURUS**

- I.—First upper labial partly (rarely not) separated from nasal by a suture; green (rarely with indistinct blackish cross-bands) above, upper lip and belly yellowish or greenish..... *albolabris*.  
 II.—First upper labial completely separated from nasal by a suture.  
 A.—No scales present between nasal and scale forming anterior border of pit; scales in 23-25 rows at mid-body..... *monticola*.  
 B.—One or more small scales present (rarely absent in *jerdonii* and *stejnegeri*) between nasal and scale forming anterior border of pit; scales in 19-29 rows at mid-body.  
 1.—Scales in 25-29 rows at mid-body; more than 190 ventrals.  
*mucrosquamatus*.  
 2.—Scales in 19 or 21 (23) rows at mid-body; fewer than 190 ventrals.  
 a.—Uniform green above and below save for a narrow stripe along either side of the belly..... *stejnegeri*.  
 b.—An intricate pattern chiefly composed of greenish yellow and black..... *jerdonii*.

**Trimeresurus stejnegeri**

- I.—Scales in 21 rows at mid-body..... *s. stejnegeri*.  
 II.—Scales in 19, rarely 21, rows at mid-body..... *s. yunnanensis*.





56.9,735P (118:78.2)

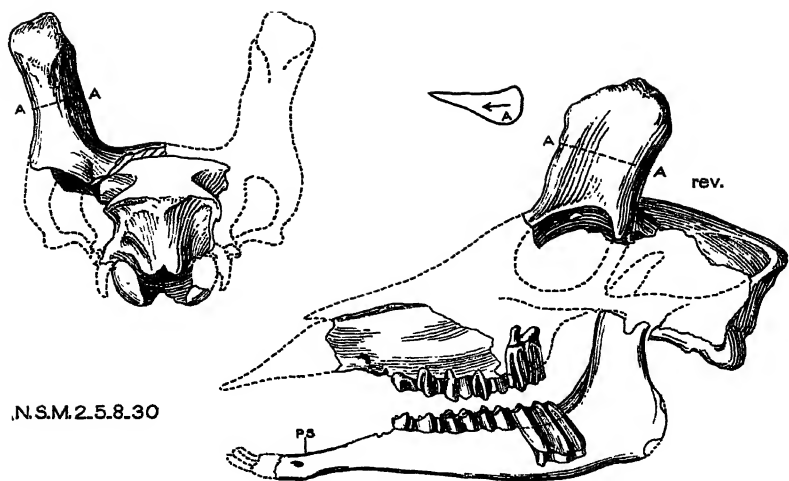
A NEW ANTILOCAPRID AND A NEW CERVID FROM THE  
LATE TERTIARY OF NEBRASKABY ERWIN HINCKLEY BARBOUR<sup>1</sup>  
AND C. BERTRAND SCHULTZ<sup>2</sup>

The present notice briefly describes two horned Artiodactyls from the Late Tertiary of northern Nebraska. The first form, *Proantilocapra platycornea*, n.g. and sp., is believed to lie near the direct ancestral line of the recent pronghorn. The second form, *Dromomeryx trigonocorneus*, n. sp., represents a heretofore unknown variant of the extinct *Dromomeryx* group. The Antilocaprid was collected in Cherry County by Paul O. McGrew and Charles Osborne for the Nebraska State Museum, and the Dromomerycid in Dawes County by Ted Galusha, of Hay Springs. The two specimens are particularly interesting as representing heretofore unknown stages of development in the Antilocapridae and Cervidae. The figure was executed by Miss H. de Berard.

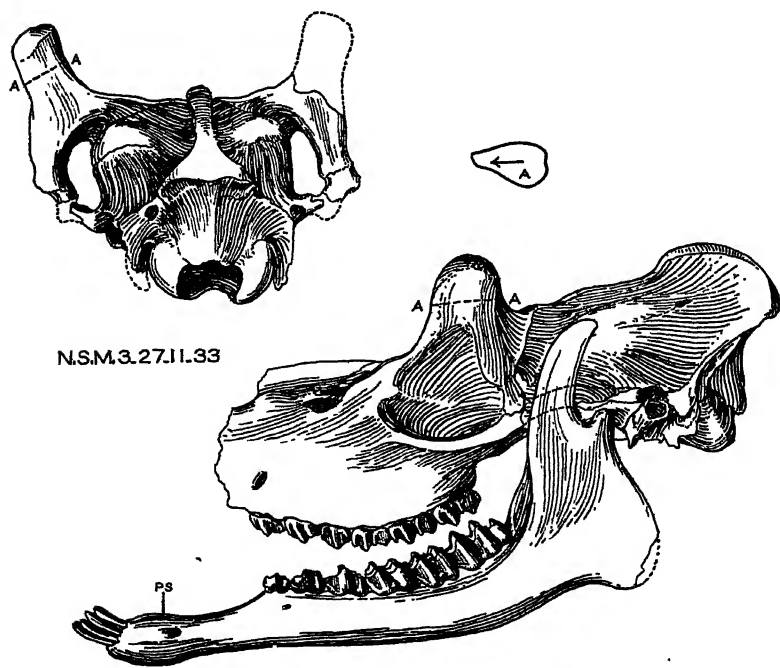
## MEASUREMENTS OF:

	<i>Proantilocapra platycornea</i> , n. g. and sp. N.S.M. 2-5-8-30	<i>Dromomeryx</i> <i>trigonocorneus</i> , n. sp. N.S.M. 3-27-11-33
Ant. p <sup>2</sup> -m <sup>3</sup> incl.....	46 mm.	61 mm.
p <sup>2</sup> .....	alv.	9
p <sup>3</sup> .....	6.6	10
p <sup>4</sup> .....	6.1	8
m <sup>3</sup> .....	9.8	13.5
Ant p <sub>2</sub> -m <sub>3</sub> incl.....	44.5	65
p <sub>2</sub> .....	alv.	7.5
p <sub>3</sub> .....	6	9.5
p <sub>4</sub> .....	7	10
m <sub>3</sub> .....	11.5	17
Humerus.....	107	142
Radius.....	119	157
Metacarpus.....	116	143
Femur.....		186
Tibia.....	168	206
Metatarsus.....	132	164

<sup>1</sup>Head Professor of Geology, University of Nebraska, and Director, Nebraska State Museum.<sup>2</sup>Assistant Curator in Paleontology and Senior Field Man, Nebraska State Museum.



N.S.M.2.5.8.30



N.S.M.3.27.11.33

Fig. 1. N.S.M.2-5-8-30, *Proantilocapra platycornea*, n. g. and sp., genotype, rev., from the Tertiary of Cherry County, Nebraska.

N.S.M.3-27-11-33, *Dromomeryx trigonocorneus*, n. sp., type, from the Tertiary of Dawes County, Nebraska.

Lateral and occipital views of skulls and mandibles  $\times \frac{1}{2}$ . PS, posterior border symphysis; AA, cross-section of horn-cores.

**Proantilocapra platycornea**, new genus and species

Figure 1 (in part)

GENOTYPE.—Partial skull with left maxilla,  $p^2$  alveolus,  $p^3$ - $m^3$  in place; left horn-core attached to a piece of the frontal portion of occipital area; two rami with partial diastemata,  $p_2$  alveolus,  $p_3$ - $m_3$  in place; associated skeletal elements including a left humerus, radius, metacarpus, distal one-half femur, tibia, metatarsus and miscellaneous ribs and vertebrae.

N.S.M. 2-5-8-30

From the Lower Pliocene, 40 feet below top of the exposed Tertiary,  $1\frac{1}{2}$  mi. N. of mouth of Steer Creek, on E. side of Snake River, Cherry County, Nebraska.

Collected August 5, 1930.

There is some evidence of the presence of a second individual.

DIAGNOSIS.—*Proantilocapra*, standing about the height of *Merycodus*, is much smaller than, although in form it makes a close approach to, recent *Antilocapra*. The teeth show a very close relationship to the Merycodinae as well as to the Antilocaprinae. The most important and typical single structure of this ancestral antelope is the horn-core, which is characteristically flattened as in *Antilocapra*, but differs from the latter in having a large tuberosus tip. The teeth are hypsodont and are almost indistinguishable from *Merycodus*, but the angle of the mandible is more prominent and the cheek-tooth series somewhat more slender and higher-crowned and  $p_3$  smaller than the nearest Merycodine form, *M. necatus sabulonis* Matthew and Cook. The limb elements of *Proantilocapra*, while similar to those of *Merycodus*, are somewhat shorter, particularly the humerus and metapodials, when compared with corresponding elements of *Merycodus osborni* Matthew. Inasmuch as the present specimen seems to furnish a new and important stage in the phylogeny of the Antilocapridae, it is deemed advisable to provide it with a significant name.

***Dromomeryx trigonocorneus*, new species**

Figure 1 (in part)

TYPE.—Partial skull, complete except for right horn-core and muzzle anterior to cheek-tooth series, with  $p^2-m^3$  present; right and left rami with  $I_1-I_3$ ,  $/C$  and  $p_2-m_3$ ; skeletal elements including left and partial right humeri, both radii, right and part of left ulnae, left metacarpus, left femur, tibia, metatarsus, tarsus, calcaneum and astragalus, two 1st, two 2d, and two 3d phalanges, ribs and etc. fragments.

N.S.M. 3-27-11-33

From the ?Upper Miocene, about 3 mi. W. of Hay Springs, on S. side of Antelope Creek, Dawes County, Nebraska.

Collected November 27, 1933. Prepared by F. Walker Johnson, Univ. Nebraska, '34.

During the preparation of the skull, a long xiphoid tusk was found in the matrix near the palate. The association is intimate enough to warrant the assumption that this is, in fact, a canine of this specimen and not that of some stray *Blastomeryx* buried there intrusively. If true, the dental formula would be:

$$\begin{array}{c} 0. \ 1. \ 3. \ 3. \\ 3. \ 1. \ 3. \ 3. \end{array}$$

DIAGNOSIS.—This specimen, though differing widely from *Dromomeryx* proper, seems to have the same general character of horn, low-crowned dentition, and prominent occiput, so we are referring it to that genus. Its brachyodont teeth are suggestive of both *Dromomeryx* and the smaller *Blastomeryx*. The horn-core resembles that of a rudimentary, much shortened *Dromomeryx* core both in its triangular cross-section and in the indication of a slight postorbital flange. The form is characterized by the large unreduced premolars, moderate diastema, peculiar blunt horn-cores with tuberos tips, produced occiput, and swollen post-sagittal ridge. Lachrymal vacuities are present. The condition of the muzzle, unfortunately, is not shown. The presence of horns, the position of the orbit, which is slightly less anterior, and the larger size exclude it from *Blastomeryx*, as so far known. The dentition differs definitely from that of *Protoceras*, which the depressed frontal area of the cranium and the upward swinging bases of the horn-cores at first glance recall. The limb elements are of unusually heavy proportions.

# AMERICAN MUSEUM ~~NOVITATES~~

Number 735

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

August 3, 1934

56.9, 71 S (118:82.9)

## A NEW NOTOUNGULATE FROM THE EARLY TERTIARY OF PATAGONIA<sup>1</sup>

BY GEORGE GAYLORD SIMPSON

The most remarkable discovery of the Scarritt Expedition of 1933-34 to Patagonia is a highly fossiliferous pocket in Early Tertiary rocks in central Chubut. This deposit, which we have called the Scarritt Pocket (Rincón de Scarritt), is on the west side of the Sierra or Meseta Canquel in a great embayment known locally as the Rinconada de los Lopez, from an Indian family that formerly lived there. In an air line it is roughly one hundred ten kilometers north-northeast of the settlement of Colonia Sarmiento and ninety kilometers south-southeast of Paso de los Indios on the Chubut River. Although the region is sparsely settled by sheep herders, it is extremely difficult of access and has not been mapped, nor, as far as known, has any previous collecting or scientific exploration been done there.

The fossil deposit will be described in more detail later. It seems to represent the crater filling of an extinct early Oligocene or Eocene volcano, with a thin series of laminated bentonites, deposited in a small, shallow, and probably very evanescent crater lake, together with a thicker filling of ashes, grading into heavy breccia near the crater walls. The whole series contains numerous fossils, which are for the most part fragmentary except in the laminated bentonites where complete, articulated skeletons occur, crushed by the shrinking of the bentonites but otherwise well preserved. It may be conservatively estimated that at least one hundred, and possibly several hundred, complete skeletons are here buried where they can be reached with moderate excavation, and this should become one of the outstanding localities for fossil vertebrates.

The common species in the lake strata is a large notoungulate which appears to be new, and the purpose of the present note is to announce this discovery and to name this new animal. A detailed, monographic account will appear later, but may be long delayed owing to the difficulty of adequate preparation and other factors.

---

<sup>1</sup>Publications of the Scarritt Expeditions, No. 21.

**SCARRITTIA**,<sup>1</sup> new genus

TYPE.—*S. canquelensis*, new species.

DIAGNOSIS.—Large, heavy notoungulates with at least the three central hoofs depressed but deeply fissured. Dental formula  $\frac{3.1.4.3}{3.1.4.3}$ , no distinct diastemata. Mesodont, all teeth rooted.  $I^1$  enlarged.  $I_{1-2}$  small,  $I_3$  moderately enlarged.  $C^1$  as small as or smaller than adjacent teeth. Upper premolars with protoloph weak or absent, central fossa opening anteriorly. Molars of simple, homalodotheri-like pattern. Upper molars with strong protoloph, relatively weak hypocone, posterior cingulum strong and enclosing small fossette.  $M^3$  enlarged and elongated.

**Scarrittia canquelensis**,<sup>2</sup> new species

HORIZON AND LOCALITY.—Early Tertiary, Scarritt Pocket, Central Chubut, Argentina.

TYPE.—A specimen not collected and now unidentifiable.<sup>3</sup>

DIAGNOSIS.—Sole known species of genus as defined above. Skull length individually variable but reaching 51 cm. (probably near the maximum).

This strange animal is at once distinguished from almost any with which it might otherwise be confused by the greatly enlarged  $I^1$ , somewhat enlarged  $I_3$ , and relatively small size of the other incisors. The cheek teeth, also, are distinctive, but less so, as the pattern of these is rather stereotyped in all but the most advanced notoungulates. Contrast with genera of which only cheek teeth are known is thus less marked, without this warranting the suggestion that they therefore are more closely related. The parts in which the greatest differences are to be expected are simply not known in these cases.

*Pleurocoelodon*, judging from figures of the isolated upper molars, is doubtfully distinct from *Trimerostephanus*, and the latter is very unlike *Scarrittia*. *Lophocoelus* is another dubious genus of the same group. *Scaphops* and *Steniogenium* are considered by Loomis synonyms of *Leontinia*, and therefore there is no reasonable possibility of very close relationship to *Scarrittia*. *Diorotherium* has a large canine and seems to be close to *Homalodotherium* and distant from *Scarrittia*.

<sup>1</sup>For H. S. Scarritt, patron of the Scarritt Expeditions.

<sup>2</sup>Geographic name from Sierra or Meseta Canquel (pronounced Kan-kel')

<sup>3</sup>This somewhat unusual procedure seems necessary and justified. Nothing in the accepted rules of nomenclature invalidates such a designation of type. The genus and species are not in any sense of the word hypothetical, but are based on definite, accurate notes made from an actual specimen which was carefully studied but which was not collected and was necessarily left under circumstances which make its subsequent identification or collection impossible. There is, however, every reason to believe that it is the common quarry species, excellent specimens of which are permanently preserved, but it is undesirable to delay publication until these are prepared and studied.

The genera most difficult to distinguish from *Scarrittia* are *Henricofilholia* and *Pyrалophodon* of the Deseado and *Carolodarwinia* of the Musters. The first two were referred by Ameghino to the Colpodontidae and the last to the Leontiniidae, two families now commonly considered synonymous.

*Carolodarwinia* is known only from an upper premolar,<sup>1</sup> which, as in *Scarrittia*, has a very feeble protoloph and the central valley opening on the anterior border of the tooth. The squared, pyramidal protocone, however, is unlike *Scarrittia* and the metaloph appears to be weaker. The genera may be closely related, but *Carolodarwinia* is practically indeterminate and too poorly known for any very valuable comparison. In *Pyrалophodon* the upper molar (M<sup>1</sup>?) figured by Ameghino is simpler than in *Scarrittia*, and the metaloph is markedly shorter, the hypocone smaller. In *Henricofilholia* (the species of which are, incidentally, considerably smaller than that here described), the external folds or columns and the internal cingulum are stronger on the upper molars, the other secondary crests and folds rather weaker and different in detail. The genera may well be related, but can hardly be identical.

*Scarrittia* is tentatively referred to the Leontiniidae. It also resembles the Homalodotheriidae to some extent, but the reduction of the canines and some other details are somewhat more suggestive of *Leontinia* and its allies. The possibly most closely related forms, *Carolodarwinia* and *Henricofilholia*, are also commonly referred to the Leontiniidae (or Colpodontidae)<sup>2</sup> and this collocation may well be retained unless good contrary evidence is discovered.

<sup>1</sup>The canine (?) ascribed to it by Ameghino is too doubtful for serious consideration.

<sup>2</sup>Loomis places *Henricofilholia* in the Isotemnidae, but on what grounds is uncertain as the only resemblance he notes is with *Leontinia*.





59.57, 99 C (6)

SOME BEES OF THE GENUS *CERATINA* FROM AFRICA<sup>1</sup>

By T. D. A. COCKERELL

The bees recorded below are all from the collections of Messrs. Lang and Chapin, except the two from Natal. All are in The American Museum of Natural History.

*Ceratina diloloensis* Cockerell

Belgian Congo: Stanleyville, two females and two males, March, April. The scutellum is considerably larger than in *C. lucifera* Cockerell, a species occurring from Elisabethville to Tshibinda, with black tubercles strongly fringed with light hair, and in general closely resembling *C. diloloensis*.

*Ceratina durbanensis*, new species

MALE.—Length about 8.2 mm.; very robust, black, the tergites not fimbriate; labrum (which has a shining median groove), mandibles, antennae, tubercles, and tegulae black, except that the labrum has a small yellow spot at lower end, far from clypeus; clypeus with a large triangular orange mark covering the greater part of its surface, leaving only the margins dark, this orange area being dullish and strongly sculptured; face very densely punctured, but a shining band at each side of upper part of clypeus, and a polished area on each side above level of top of clypeus but below level of antennae; disc of mesothorax broadly shining, with the strong punctures widely spaced; scutellum very densely and coarsely punctured; wings fuliginous; second cubital cell rather narrow; legs black, front femora all black, but their tibiae with a white stripe nearly to the end, and a small white spot on hind knees; abdomen broad, coarsely sculptured, sixth tergite obtusely keeled apically; seventh tergite not at all prominent; apex of venter with a small pit.

Natal: Durban, 1917 (No. 4969; collector's name not given). My manuscript key to male *Ceratina* will aid in separating this species from certain of its relatives.

- 1.—Labrum all black. .... 2.  
     Labrum with a light spot, far from clypeus. .... 3.
- 2.—Clypeal mark smooth and highly polished (National Park, Natal; A. Mackie).  
     *politula* Ckll.  
     Clypeal mark coarsely punctured (Tshibinda, Belgian Congo; J. Ogilvie).  
     *lucifera* Ckll.
- 3.—Clypeal mark smooth and polished, with hardly any punctures; small species  
     (Greytown, Natal; J. Ogilvie). .... *politula griseipennis* Ckll.  
     Clypeal mark rough and coarsely punctured. .... 4.

<sup>1</sup>Scientific Results of the Congo Expedition. Entomology No. 26.

- 4.—Larger and more robust, clypeal mark orange.....*durbanensis* Ckll.  
 Smaller and more slender, clypeal mark creamy white (Tenke, Katanga; J.  
 Ogilvie).....*lucifera sidiifera* Ckll.

### *Ceratina geigeriae* Cockerell

**FEMALE.**—Length about 6.2 mm.; black, a sort of blue-black, the face more distinctly bluish; labrum and mandibles black; flagellum faintly brownish beneath; tegulae very dark brown; tubercles broadly tipped with yellowish white; clypeal mark a vertical bar, pale but dull yellow, shining, broadening toward lower end, with a pair of raised lines running from upper part to near lower end, converging below, on the black part of clypeus at sides of mark a regular row of well-defined punctures and outside of these a row of very minute punctures; head and thorax very densely punctured, including disc of mesothorax; scutellum densely punctured, with a shining spot in middle anteriorly; metathorax with a broad dull basal area; wings dilute fuliginous, strongly brown; second cubital cell with a broad face on marginal; legs dark brown; front femora with a white stripe beneath, their tibiae with a white stripe; hind tibiae with a white mark at base, and much white hair, there is no tooth on hind margin; abdomen black, finely sculptured, tergites fimbriate at sides, the flattened hairs reddish; keel of sixth tergite extremely weak, hard to see.

Belgian Congo: Banana, August, 1915 (Lang and Chapin). I give a description of this insect, which varies a little from the Angola type of *C. geigeriae* but is certainly the same species. In the type of *C. geigeriae* the flattened hairs fringing the tergites at sides are white. This species extends to Liberia, where it was taken by Dr. J. Bequaert.

### *Ceratina langi*, new species

**FEMALE.**—Length about 7.4 mm., anterior wing 6.2; strongly punctured, glistening, very dark green, the apical part of the abdomen dark blue; mandibles, labrum, antennae, tegulae, and legs black, the legs without light markings, but the tarsi slightly rufescent apically; tubercles black, with slightly brownish hair; labrum with a median groove; clypeus very peculiar, it is large and high, presenting a large shining impunctate surface, somewhat concave above, transversely swollen below, the upper boundary of this space forming an edge, above which is a dull yellow transverse bar, rather less than one-third of diameter of face; at each side of clypeus, next to the lower edge, is a short yellow vertical shining band; punctures of head and thorax extremely coarse, disc of mesothorax shining between punctures; axillae not produced; scutellum densely punctured; base of metathorax with a slender shining transverse channel; wings dark fuliginous; stigma very dark; marginal cell broad; in the type, on both sides, the third cubital cell is transversely divided into two, but this must be abnormal; second cubital cell very large, much narrowed above; hair on inner side of tarsi rufous; tooth on hind tibia well beyond the middle; abdomen very broad, rough; sixth tergite neither keeled nor grooved; tergites not fimbriate.

Belgian Congo: Stanleyville, March, 1915 (Lang and Chapin). A very distinct species, apparently a metallic relative of the group of *C.*

*lunata* Friese, but with unique clypeal markings. The lateral marks somewhat recall those of *C. sculpturata* Smith, from Senegal.

***Ceratina mimula* Cockerell**

Natal: Durban (No. 4457; collector's name not given.)

***Ceratina musarum*, new species**

**FEMALE.**—Length about 6.5 mm.; black, the face rather blue-black, the abdomen obscurely greenish; mandibles, labrum, tubercles, and tegulae black; flagellum very obscurely brownish beneath; clypeal mark orange, highly polished, with a few large punctures near lower corners, the upper part shaped like the end of a finger, but distinctly tapering and not truncate, with small lateral projections below; in two of the three specimens the clypeal mark is light yellow; labrum coarsely punctured and with a large basal pit; a shining, sparsely punctured band behind ocelli; head and thorax densely punctured, but disc of mesothorax with very large, distinctly separated punctures; scutellum densely punctured; base of metathorax dull; wings with apical half dilute brownish; stigma large, very dark brown, second cubital cell not broad above; legs black, with small joints of tarsi more or less reddish; front femora all black, but their tibiae with a white stripe on basal half; tooth of hind tibia far from base but before the middle; tergites slightly fimbriate at sides; sixth tergite with a complete distinct keel.

Belgian Congo: Banana, August-September, 1915, three specimens (Lang and Chapin). Several similar females are separated as follows.

- 1.—Clypeal mark white or creamy white, with a median groove; front tibiae with a white stripe at base; tergites very strongly fimbriate (Elisabethville; W. P. Cockerell)..... *crassula* Ckll.
  - 2.—Clypeal mark yellow or orange..... 2.
  - 3.—Clypeal mark very narrow, narrowest above..... *bukavana* Ckll.
  - 4.—Clypeal mark not very narrow..... 3.
  - 5.—Clypeal mark with a strong groove..... 4.
  - 6.—Clypeal mark not or not evidently grooved..... 5.
  - 7.—Front tibia with a pale stripe..... *crassula* Ckll. var. *a*.
  - 8.—Front tibia with no light stripe..... *crassula* Ckll. var. *b*.
  - 9.—Larger; clypeal mark truncate above (Liberia)..... *insuta* Ckll.
  - 10.—Smaller; clypeal mark narrowed above..... *musarum* Ckll.
- The last two are perhaps races of a single species.

***Ceratina viridifrons* Cockerell**

Belgian Congo: Faradje, January, 1913, one female. This is allied to *C. viridis*, but is very much darker, the mesonotum and scutellum being black. The white clypeal mark is very broad. The type, from Tenke (J. Ogilvie), has the abdomen blue, basal half greenish, and the hind tibiae with only a small light mark at base. The Faradje specimen has the abdomen dark green, and the hind tibiae with a large basal mark,

but the hind basitarsi are not black, as they are in a variety from Congo da Lemba (R. Mayné). The species appear to be very variable.

***Ceratina viridis* Guérin**

Belgian Congo: Banana, both sexes, August, 1915; Malela, July 5, 1915, male; Gamangui, February, 1910, male; Garamba, July, 1912. female; Stanleyville, April, 1915, ten females.

59.31,2 (74.7)

SOME FORAMINIFERA FROM WESTERN LONG ISLAND AND  
NEW YORK HARBOR

BY BENJAMIN SHUPACK

This paper describes Pleistocene and Recent Foraminifera from western Long Island and New York Harbor. Very few Foraminifera occur in this region: six species of *Elphidium* and two species of *Rotalia*. The Pleistocene and Recent Foraminifera are identical.

The Foraminifera of Long Island and New York Harbor have not as yet, to my knowledge, been the subject of any published article. Feeling that my interest in the Foraminifera of Long Island may be shared by others, I have made them the subject of this paper, and have been spurred on in my research by the easy accessibility of this region.

The bottom muds of Jamaica Bay and of Lower New York Bay were the main sources of material. There came, also, an opportunity to add to these Recent muds some Pleistocene clay secured from the water supply tunnel built in Brooklyn during 1929 and 1930.

Material from the bottom was collected in water varying from one to forty feet in depth, for which special instruments were needed. The bottom sampler, here known as the "bulldog snapper," B in figure 1, plans for which were supplied by the Bureau of Fisheries, requiring as it does the jar of up and down impact to spring the jaws shut, was found impracticable for use from a moving boat or in deep ooze. Moreover, though it worked well from a stationary position such as a dock, bridge, or an anchored boat, its weight of fifty pounds, added to that of the waterproof containers necessary for carrying the wet mud, made it difficult to transport. The six-inch length of pipe designed by Dr. Albert Mann, and used by Mr. Paul S. Conger of the National Museum of Washington, to collect diatom material, suggested a simpler bottom sampler, A in figure 1, which consisted of a brass pipe twenty inches long, two and one-half inches in diameter, with a cap threaded on one end. This end of the pipe, as well as the cap, is pierced with one-eighth inch holes to allow the water to flow through and the muds to collect in the pipe. A bridle spans the distance from the leading edge to the center of gravity. The drag line snapped on and adjusted itself to the correct direction of pull for the depth of water. In use, the instrument was

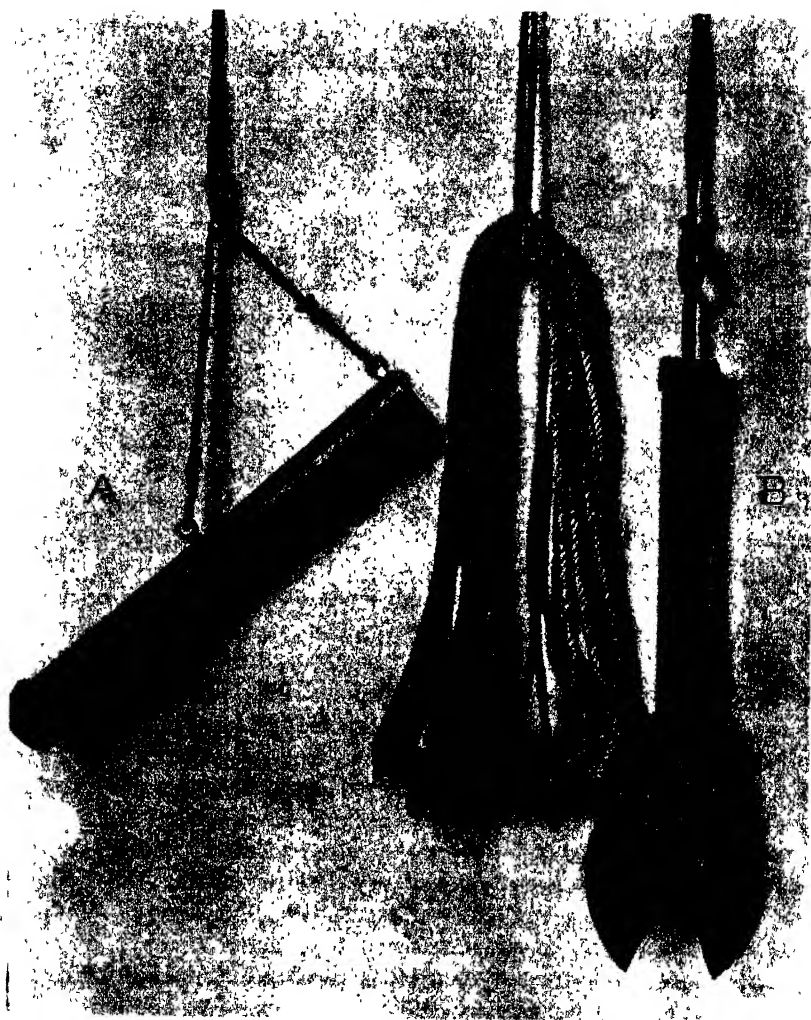


Fig. 1

tossed overboard, enough line paid out, and hauled in after a short time. This bottom sampler is light, stows easily, operates in all kinds of soft bottoms, and up to forty feet of water, which is the greatest depth in which it has been tried.

The samples from Jamaica Bay were collected from a seventeen-foot sloop. The samples from the bottoms of the creeks of Jamaica Bay were black mud, which washed easily, leaving a residue of small angular sand grains, glauconite grains, Foraminifera, gastropods, and fish teeth. The sandy parts of the Jamaica Bay bottom do not have any organic remains. The localities from which Foraminifera-bearing material was collected are plotted on the chart of New York Harbor, figure 2.

Mr. Charles M. Breder, of the New York Aquarium, offered the use of the Aquarium boat, the 'Sea Horse,' to get samples from New York Harbor. The crew coöperated in securing samples from the vicinity of Sandy Hook with the "bulldog snapper," the only bottom sampler then available. The localities dredged were plotted on the chart of New York Harbor, figure 2. The samples were sandy with a great many pelecypod fragments, among which were Foraminifera.

Drill samples from test bores in Raritan Bay, collected by the New York Port Authority in locating the piers for a new bridge, were turned over to me by Professor Charles P. Berkey, of Columbia University, for micropaleontological examination. Some of the drill samples contained a great many Foraminifera, a study of which is included in this paper. The location of the test borings is indicated on the chart, figure 2.

The Pleistocene clay secured with the help of Dr. H. R. Blank, geologist in charge of the City Tunnel No. 2 of the water supply system of New York City, was collected 150 feet below the surface of Hamilton Avenue in Brooklyn (Fig. 2, Station P). After the clay had been soaked for two days and then washed it was found to contain a great many pelecypod fragments, fish teeth, gastropod shells, and many Foraminifera.

The possibility that the salinity might vary and have an effect on the foraminiferal fauna induced me to determine the salinity of the water in Jamaica Bay and Sandy Hook. The salinity of waters from which Foraminifera were collected varied from 2.75 per cent in Jamaica Bay to 2.8 per cent at Station 4 and 3.3 per cent in New York Harbor and Sandy Hook. At the Jamaica Bay and Sandy Hook localities, which are about fifteen miles apart, specimens of Foraminifera were collected from two age levels, the Pleistocene and the Recent. Despite the variations of salinity and the distance apart from which specimens were



secured as well as the different ages, the Foraminifera were almost identical. The identity of the Pleistocene and Recent Foraminifera collected from the two localities is remarkable, moreover, because Station P is a subsurface bed of clay, generally supposed to extend

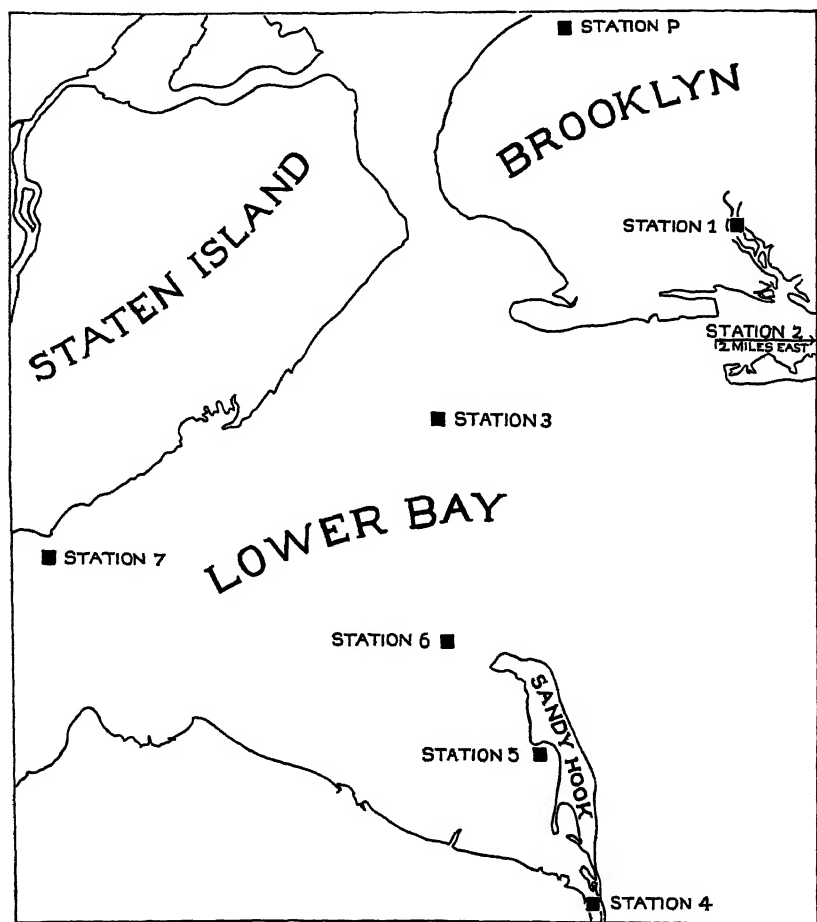


Fig. 2

throughout Long Island, lying between beds of sand and gravel. The identity of Foraminifera is notable also because Station 7 is a silted-in pre-Pleistocene river channel in Cretaceous sands covered by recent muds and sands. It might have been supposed that the great pollution of the waters of New York Harbor should have made a differ-

ence in variety of genera and species of Foraminifera collected from the different localities, but such is not the case. Should the Pleistocene and Recent groups taken from waters of varying salinity and purity be mixed, great difficulty would be encountered in identifying them individually. For this reason Foraminifera of this region differing in age level and locality will be discussed as one group.

The foraminiferal fauna seems limited to two genera and eight species: *Elphidium* (synonym *Polystomella*) with six species, of which two are new; and *Rotalia* with one species and a new variety of another species.

The holotypes and figured specimens are deposited in The American Museum of Natural History.

The figures for illustration were prepared by Miss Lee Barkman. Outlines were drawn with the aid of a camera lucida and checked by me.

I wish to acknowledge my indebtedness and appreciation to the following persons for their aid in the preparation of this paper: Mr. Hugo Leipniker and Mrs. Florentina Leipniker for translations of original descriptions in German and Latin and Miss Lee Barkman for her excellent illustrations.

Many more dredgings and collections of material were made than indicated by the eight stations listed below. It was thought best for the sake of simplicity and brevity to select a station representative of each locality.

Station 1.—Recent; north end of the dock at Watkins Canoe Landing at the head of Flatlands Creek. This creek is to be filled in shortly, in accordance with the improvement program of New York City.

Station 2.—Recent; the west side of Cross Bay Boulevard, one-half mile below Howard Beach.

Station 3.—Recent; just north of the West Bank lighthouse in Lower New York Bay.

Station 4.—Recent; Bennett's gasoline dock at Highlands, New Jersey.

Station 5.—Recent; inside the Horseshoe at Sandy Hook.

Station 6.—Recent; one and one-quarter miles west of Sandy Hook lighthouse, at some fish ponds.

Station 7.—Pleistocene; Hole number 4 of the Raritan Bay Bridge borings one-quarter mile south of Seguin point and 109 feet below sea level.

Station P.—Pleistocene; Shaft 17a of City Tunnel No. 2 of the Board of Water Supply of the City of New York at Hamilton Avenue, Brooklyn, and 150 feet below sea level.

RANGE TABLE

	Recent						Pleistocene	
	1	2	3	4	5	6	7	P
<i>Rotalia beccarii</i> var. <i>sobrina</i>	C	C	R	C	C	C	C	C
<i>Rotalia repanda</i>	N	N	N	N	N	N	N	R
<i>Elphidium florentinae</i>	A	A	N	C	C	C	C	C
<i>Elphidium gunteri</i>	C	C	R	C	C	C	C	C
<i>Elphidium brooklynense</i>	A	A	N	C	C	C	C	C
<i>Elphidium clavatum</i>	C	C	C	C	C	C	C	A
<i>Elphidium discoidale</i>	N	N	R	N	N	R	N	R
<i>Elphidium incertum</i>	N	R	R	N	C	C	C	R

A=abundant; C=common; R=rare; N=none.

### ROTALIA Lamarek, 1804

#### *Rotalia beccarii* (Linné) *sobrina*, new variety

Figure 4, a, b, c

Not *Rosalina parkinsoniana* D'ORBIGNY, 1839, in De la Sagra, 'Hist. Fis. Pol. Nat. Cuba, Forams.', p. 99, Pl. IV, figs. 25-27. (Recent.)

*Rotalia beccarii* (Linné) var. *parkinsoniana* CUSHMAN, 1930, 'Contrib. Cushman Lab. Forams. Res.', VI, part 4, p. 100, Pl. XIII, figs. 14a-c. (Pleistocene, Maryland.)

*Rotalia beccarii* (Linné) var. *parkinsoniana* COLE, 1931, Florida Geol. Survey, Bull. 6, p. 49, Pl. III, figs. 5, 6. (Pleistocene and Pliocene, Florida.)

Test biconvex, coiled in a low spire, the dorsal side more convex than the ventral side; peripheral margin subacute; periphery entire; chambers nine to ten in the last whorl; sutures distinct, limbate, and flush with the surface; umbilicus with a large plug of clear shell material, sometimes with one or two smaller bosses; wall smooth, lustrous, with pores of medium size; aperture a slit at the base of the last chamber, between the periphery and the umbilical plug. Diameter, 0.30 mm. to 0.65 mm.; thickness, 0.15 mm., to 0.40 mm.

This variety is the same as figured and described by Cushman but does not seem to be *Rosalina parkinsoniana* D'Orbigny, whose figures show a lobulate margin, more nearly planispiral coiling, and the chambers are more closely appressed, more curved, and the sutures are not limbate.

This variety is found in both the Pleistocene and the Recent, though not of common occurrence, and differs from *R. beccarii* in smaller and more inflated chambers that are truncate toward the umbilicus, in the less limbate sutures, and in the adult form possesses a single umbilical plug, not one broken up into several bosses.

No typical full-grown forms of *R. beccarii* such as those found in the Adriatic occur in this region; all forms found are dwarfed or stunted and, since they occur at all stations and in all environments, they must be full-grown forms.

It is apparent, also, that the habitat has something to do with the particular characteristics, and that this variety is adjusted to the particular habitat in which it lives.

The holotype is in The American Museum of Natural History (Cat. No. A. M. N. H. 697).

### ***Rotalia repanda* (Fichtel and Moll)**

Figure 3, a, b, c

*Pulvinulina repanda* and *Eponides repandus* of authors. For synonymy, see CUSHMAN, 1931, Bull. No. 104, U. S. Nat. Mus., part 8, p. 49.

Test biconvex, more convex on the dorsal side, coiled in a spire; peripheral margin acute, periphery entire; chambers eight in the last whorl; umbilicus filled with the extension of the seventh chamber; sutures distinct, slightly depressed on the ventral side, slightly limbate on the dorsal side, the dorsal ones more curved than the ventral ones; wall smooth, very finely perforate; aperture a slit at the base of the last septum between the periphery and the umbilicus, widening toward the umbilicus, with large pores scattered over the septal face of the last chamber. Diameters: larger 1.2 mm., smaller 1 mm.; thickness, 0.40 mm. Occurrence: very rare in the Pleistocene in the vicinity of New York.

In identifying this form as *Pulvinulina repanda* and *Eponides repandus* two questions are raised:

1. Is this form generally recognized as *P. repanda* and *E. repandus* the same as Fichtel and Moll's *Nautilus repandus*?
2. Is *Eponides* a synonym of *Rotalia*?

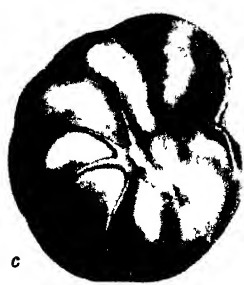
Many authors have recognized the form here described as being the one described and figured by Fichtel and Moll as *Nautilus repandus*. But just what *N. repandus* is, is doubtful, for the original figures are not recognizable and the original description is hard to visualize. No known form has yet been found to correspond with Fichtel and Moll's figures. To really settle the question the original material would have to be re-examined. The *P. repanda* and *E. repandus* of many authors seem to differ from the *N. repandus* of Fichtel and Moll in that the whorls are not involute on both sides; the sutures are not limbate on the dorsal



3a



b



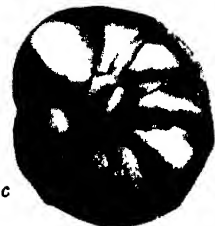
c



4a



b



c



5a



b



6a



b



7a



b



8a



b



9a



b



10a



b

side; and there are large irregular pores on the septal face. To change the name of *E. repandus* of many authors would be pointless, since *E. repandus* has become established in the literature, and there is little likelihood of ever finding out what *N. repandus* really is.

The generic difference that supposedly separates *Eponides* from *Rotalia* is the absence of an umbilical plug. That this is a generic difference is doubtful, for many genera have species with and without the umbilical plug. The presence or absence of an umbilical plug is here regarded as a specific difference only.

The described and figured specimen is in The American Museum of Natural History (Cat. No. A. M. N. H. 702).

### ELPHIDIUM Montfort, 1808

(Synonym: *Polystomella* Lamarck, 1822)

#### KEY TO SPECIES OF *Elphidium*

Umbilical region filled with bosses.

Peripheral margin broadly rounded

Sutures of clear shell material, the last with pores or retral processes.

*E. florentinae*.

Sutures with pores and retral processes.

Sutures with pores.

All sutures with pores.....*E. gunteri*.

With retral processes in last two sutures.....*E. brooklynense*.

Sutures with retral processes.....*E. clavatum*.

Periphery subacute.....*E. discoidale*.

Umbilical region without bosses.....*E. incertum*.

### *Elphidium florentinae*, new species

Figure 5, a, b

Test bilaterally symmetrical; peripheral margin rounded; periphery entire or slightly lobulate; umbilical region ornamented with bosses of clear shell material; chambers in the last whorl vary in number from nine to ten; usually nine, slightly inflated; sutures with wide bands of clear shell material, except the last two, which have a single row of pores; wall smooth, transparent, finely perforate; aperture composed of a number of round holes at the base of the apertural face. Diameter, 0.50 mm. to 0.70 mm.; thickness, 0.25 mm. Occurs frequently.

Fig. 3, a, b, c.—*Rotalia repanda* (Fichtel and Moll).

Fig. 4, a, b, c.—*Rotalia beccarii* (Linné) *sobrina*, new variety.

Fig. 5, a, b.—*Elphidium florentinae*, new species.

Fig. 6, a, b.—*Elphidium gunteri* Cole.

Fig. 7, a, b.—*Elphidium brooklynense*, new species.

Fig. 8, a, b.—*Elphidium clavatum* Cushman.

Fig. 9, a, b.—*Elphidium discoidale* (D'Orbigny).

Fig. 10, a, b.—*Elphidium incertum* (Williamson).

This species would be a *Nonion* were it not for the pores that begin to appear indistinctly in the next to the last suture and show quite distinctly in the last suture. This characteristic is constant and shows in specimens collected fifteen miles apart. This species is much more abundant in samples collected close to shore and in less than ten feet of water.

This species is named in honor of my wife, Florentina Shupack, who has greatly assisted me in the collection of the material.

The holotype is in The American Museum of Natural History (Cat. No. A. M. N. H. 696).

### ***Elphidium gunteri* Cole**

Figure 6, *a*, *b*

*Elphidium gunteri* COLE, 1931, Florida State Geological Survey, Bull. 6, p. 35, Pl. iv, figs. 9, 10. (Pliocene, Orange City, Florida.)

Test large; peripheral margin broadly rounded; periphery entire; the apertural face makes an angle of 136 degrees with the inner periphery; umbilical region flush with the surface, ornamented by clear bosses arranged regularly around a central boss; chambers are inflated and thirteen in the last whorl; sutures are distinct, marked by single rows of large pores five to seven in number; wall smooth, lustrous, perforate; aperture a series of small round holes at the base of the apertural face. Diameter, 0.90 mm.; thickness, 0.40 mm.

This species differs from *E. hughesi* Cushman and Grant in that *E. hughesi* has a lobulate margin and the umbilical region is slightly depressed. This species differs from *Polystomella poeyana* D'Orbigny in that the sutures do not reach to the minute umbilicus.

The described and figured specimen is in The American Museum of Natural History (Cat. No. A. M. N. H. 701).

### ***Elphidium brooklynense*, new species**

Figure 7, *a*, *b*

Test very little compressed, bilaterally symmetrical; peripheral margin rounded; periphery entire or slightly lobulate; umbilical region filled with bosses irregularly arranged of clear shell material; chambers in the last whorl are usually nine in number; the last chamber is inflated; sutures are filled with large pores except for the last two, which are marked by retral processes, five to eight in number; wall smooth, transparent, finely perforate; aperture a number of round holes at the base of the apertural face. Diameter, 0.50 mm. to 0.80 mm.; thickness, 0.25 mm. Occurs frequently.

This species consistently has only the last two sutures ornamented with retral processes and in this respect differs from *E. gunteri* Cole. It seems to be the transitional form between *E. gunteri* and *E. clavatum*. It is numerous in samples collected close to shore in ten feet or less of water.

The holotype is in The American Museum of Natural History (Cat. No. A. M. N. H. 695).

***Elphidium clavatum* Cushman**

Figure 8, a, b

*Elphidium incertum* (Williamson) var. *clavatum* CUSHMAN, 1930, Bull. 104, U. S. Nat. Mus., part 7, p. 20, Pl. VII, figs. 10a, b. (Recent, found in the 'Albatross,' dredgings in deep or cold water north of Hatteras, along the continental shelf.)

*Elphidium incertum* (Williamson) var. *clavatum* CUSHMAN, 1930, 'Contrib. Cushman Lab. Foram. Res.,' VI, part 4, p. 69, Pl. XIII, figs. 8, 9. (Pleistocene, Maryland.)

Test small; peripheral margin rounded; periphery entire or slightly lobulate; umbilical region ornamented by irregularly arranged bosses, very distinct but not forming an umbonate mass; chambers in the last whorl vary in number from nine to eleven, slightly inflated; sutures distinct marked by retral processes five to seven in number on each side; wall thick, opaque, with pores of medium size; aperture consists of several small round holes at the base of the apertural face. Diameter, 0.50 mm. to 0.80; thickness, 0.25 mm. Occurs in moderate number.

This species differs from *E. incertum* (Williamson) in that the chambers do not reach the minute umbilicus but consistently end in irregular bosses.

Although the description of the type specimen states that the umbilical region is not a definite umbonate mass, the figure of the type specimen shows a distinct umbo.

The described and figured specimen is in The American Museum of Natural History (Cat. No. A. M. N. H. 700).

***Elphidium discoidale* (D'Orbigny)**

Figure 9, a, b

*Polystomella discoidalis* D'ORBIGNY, 1839, in De la Sagra, 'Hist. Fis. Pol. Nat. Cuba, Forams.,' p. 56, Pl. VI, figs. 23-24. CUSHMAN, 1922, Publ. 311, Carnegie Instit. Washington, p. 56, Pl. X, figs. 3, 4; 1926, Publ. 344, p. 80. (Recent.)

*Elphidium discoidale* (D'Orbigny), CUSHMAN, 1930, Bull. 104, U. S. Nat. Mus., part 7, p. 22, Pl. VIII, figs. 8, 9. (Recent, found in the 'Albatross' dredgings.)

Test biconvex; peripheral margin subacute; periphery slightly lobulate; the umbilical regions consist of large clear rounded bosses which protrude beyond the outline of the test in peripheral view; chambers inflated and twelve in last whorl; sutures distinct, slightly depressed, marked on each side by six to seven indistinct retral processes; wall smooth, transparent, perforate; aperture consists of several small round holes at base of apertural face. Diameter, 0.90 mm.; thickness, 0.40 mm.

This species differs from *E. discoidale* of Cushman in having two more chambers and fewer retral processes.

The described and figured specimen is in The American Museum of Natural History (Cat. No. A. M. N. H. 699).



**Elphidium incertum** (Williamson)

Figure 10, a, b

*Polystomella umbilicatulula* var. *incerta* WILLIAMSON, 1858, 'Rec. Foram. Ct. Britain,' p. 44, Pl. III, figs. 82, 82a.

*Polystomella striato-punctata* var. *incerta* KIAER, 1930, Rept. Norwegian Fish Mar. Invest., I, No. 7, p. 51.—CUSHMAN, 1913, Rept. Canadian Arctic Exped., part M, p. 10.

*Polystomella decipiens*, HERON, ALLEN AND EARLAND (not Costa), 1916, Trans. Linn. Soc. London, (2) XI, p. 282, Pl. XLIII, figs. 20, 22.

*Elphidium incertum* CUSHMAN, 1930, Bull. 104, U. S. Nat. Mus., part 7, p. 18, Pl. VII, figs. 4-9. (Recent, Atlantic Ocean.)

*Elphidium incertum* CUSHMAN, 1930, 'Contrib. Cushman Lab. Foram. Res.,' VI, part 4, p. 96, Pl. XIII, figs. 6, 7. (Pleistocene, Maryland.)

Test compressed; peripheral margin rounded; periphery entire; umbilical region slightly depressed; chambers are ten in the last whorl; sutures distinct, meandering, depressed, marked by one or two retral processes; wall thick, opaque; aperture composed of several small round holes at the base of the apertural face. Diameter, 0.60 mm.; thickness, 0.25 mm.

The described and figured specimen is in The American Museum of Natural History (Cat. No. A. M. N. H. 698).

59.57,72 M (6)

## AFRICAN MUSCIDAE.—I

By C. H. CURRAN

In the present contribution the genus *Idiopygus* Malloch is discussed and a key to the known species presented. Two new species are described and notes given on the species described previously. Up to the present time the genus is known only from Africa.

**IDIOPYGUS** Malloch

MALLOCH, 1921, Ann. Mag. Nat. Hist., VIII, p. 229.

Lobes of fifth sternite of the male long and narrow; scutellum bare on the sides; anterior intra-alar bristle absent or situated behind the anterior postsutural dorsocentral bristle; hypopleura bare or with a few short hairs near the posterior spiracle; wings with three brown spots on the crossveins, one on the anterior and two on the posterior; squamae not expanded inwardly; posterior spiracle small; posterior tibiae without posterodorsal bristles or with a rather short one near the middle; arista plumose; eyes bare.

The genus resembles *Helina* Desvoidy in many respects, but it is readily distinguished in the male by the large genitalia and fifth sternite. There are usually only three sternopleurals, but the lower one may be duplicated and situated almost equidistant from the upper two. The position of the posterodorsal bristle on the posterior tibia distinguishes the genus from *Phaonia* Desvoidy and the bare wing veins from other allied genera. The genotype is *Spilographa hirtipes* Macquart.

The synonymy of the species is confused, because Stein described species in both *Spilogaster* and *Mydaea*. It is quite obvious that Malloch's *hirtipes* is identical with *mirabilis* Stein, his *ulundi*, originally described as *trochanteratus* is very likely the same as *Mydaea trochanterata* Stein and the female which Malloch thought might be *trimaculata* Stein is very probably *hirtipes* Macquart. However, it is by no means a safe practice to place species in synonymy without examining the types, and for this reason we should retain the names, at least as doubtful, until this has been done. Fortunately, Malloch's descriptions will permit of a comparison with Stein's types, since all the essential characters are enumerated.



**Idiopygus hirtipes** Macquart

*Spilogaster hirtipes* MACQUART, 1846, 'Dipt. Exot.,' Suppl. 1, p. 202.

*Mydasa hirtipes* STEIN, 1913, Ann. Mus. Nat. Hung., XI, p. 486.

Male, Vumba, Southern Rhodesia, November, 1932, at faeces (A. Cuthbertson).

A black species with remarkably shaped posterior tibiae, villous front tibiae, and a long, mammiform process in front of each middle coxa, the apex with several coarse, backwardly directed short bristles; basal segment of posterior tarsi swollen and with a row of anterodorsal bristles; front one-fifth of the head-width. Mesonotum with four narrow brown vittae, all abbreviated posteriorly, the middle pair replaced behind by a short central vitta. Scutellum wholly cinereous. Abdomen with three pairs of large brown spots.

This species is so easily recognized by the shape of the tibiae, processes of the sternopleura, and wholly black legs that a complete description is unnecessary.

**Idiopygus mirabilis** Stein

*Spilographa mirabilis* STEIN, 1906, Berl. Ent. Zeitschr., LI, p. 56.

*Idiopygus hirtipes* MALLOCH, 1921, Ann. Mag. Nat. Hist., VIII, p. 230 (not Macquart).

In the reference cited above, Malloch has given a complete description of this species. It will be easily recognized by the shape of the posterior tibiae, mammiform sternopleural processes, and the reddish posterior femora with the apical third black.

**Idiopygus major**, new species

Black, cinereous pollinose; anterior tibiae with dense, long hair; posterior four legs mostly reddish; posterior trochanters of male with short, coarse bristles. Length, 8 to 10 mm.

MALE.—Head whitish pollinose, the frontal vitta black, the ocellar triangle surrounded by whitish. Front scarcely one-fifth of the head-width, with three or four pairs of frontals on the anterior half; ocellars long; outer verticals absent; occiput and cheeks with black hair; cheeks two-sevenths as wide as the eye-height. Para-facials wider than the third antennal segment. Palpi, proboscis and antennae black; basal antennal segments white above; arista long plumose.

Thorax black, densely cinereous pollinose, the dorsum cinereous yellowish; mesonotum with a pair of slender brown vittae just outside the acrostical line and in some views with blackish appearing vittae along the line of the dorsocentrals. Acrosticals, 0-1; dorsocentrals, 2-3; anterior intra-alar strong; prealar absent; four pairs of marginal scutellars, two pairs weak; sternopleurals, 2-2, the hairs bristle-like; sternopleura with a tuft of bristles immediately in front of and between the middle coxae.

Coxae black, cinereous pollinose, the posterior pair with rather abundant bristly hairs apically in front. Trochanters red, the posterior pair with abundant, short, stout bristles below. Anterior femora black, cinereous pollinose, with rather abundant bristles on the basal fourth below, the usual row of posterodorsal and posteroventral bristles and many bristles between these rows except apically; middle femora black, gray pollinose, with both ends broadly reddish; with rather numerous bristles posteriorly and posteroventrally, a row of strong bristles on the anterodorsal surface and an incomplete anteroventral row, the hair rather long basally; posterior femora reddish, usually broadly black, and gray pollinose in the middle, with rather abundant, long bristles anteroventrally, a row anterodorsally and fine bristly hair on the apical half of the posteroventral surface. Anterior tibiae reddish yellow, clothed beneath with very long, coarse, black hair which becomes soft and brown in color apically; middle tibiae reddish yellow, the lower apex produced triangularly forward and densely clothed with short black hair, posteriorly with two bristles, before the apex on the under surface with an unusually coarse bristle which is gently, doubly curved near the apical fifth; posterior tibiae gently arcuate, reddish yellow, beneath with moderately abundant, but by no means dense, long black hair, anterodorsally with two bristles near the middle, posterodorsally with long, fine bristles. Tarsi black, the anterior pair clothed behind with moderately long black hair; basal segment of the middle tarsi with a posterodorsal row of short black bristles and below these, just before the middle, subtriangularly produced, the process bearing short, black bristly hairs; posterior tarsi simple.

Wings cinereous hyaline, somewhat yellowish basally, with the usual three brown spots. Squamae white. Halteres yellow.

Abdomen cinereous pollinose; second and third segments each with a pair of broadly separated brown spots, the second with quite weak marginal bristles in the middle, the third and fourth each with strong marginals, the fourth with strong discals, the third with one or two pairs of short discals. Ventral borders of the tergites with abundant soft hair. Sternites brown, thinly pollinose. Lobes of fifth sternite reddish and unusually short for the genus. Genitalia large, cinereous pollinose, rather long-haired.

**FEMALE.**—Front almost half as wide as the head, with the white of the ocellar triangle extending more than halfway to the antennae; four pairs of frontals and a row of hairs outside them. Three or four sternopleurals. Anterior femora black, cinereous pollinose; tibiae and posterior four femora reddish yellow; tarsi black. Fourth abdominal segment without marginals, carinate at the apex above.

**TYPES.**—Holotype, male, allotype, female, and two male paratypes, Witzieshork, South East Africa (Janson), received from Mr. C. J. Wainwright.

Despite the fact that this species has the lobes of the fifth sternite much shorter than in the other species I have seen, it seems to belong to this genus, since in all other respects the male is quite typical.

#### ***Idiopygus bequaerti*, new species**

Mesonotum black with two cinereous vittae and the lateral borders cinereous; femora broadly reddish basally. Length, 6.5 mm.

**MALE.**—Head black, whitish pollinose, the parafacials silvery. Front one-eighth the head-width, black, the orbits narrow; four pairs of frontals on the anterior half,

the posterior ones weakest; ocellars long and strong. Hair black. Cheeks one-fifth as wide as the eye-height. Parafacials narrower than the antennae. Proboscis, palpi, and antennae blackish; arista long plumose, brownish sub-basally. Eyes bare.

Thorax black; mesonotum brown pollinose, the broad sides and a pair of moderately wide vittae along the dorsocentral line cinereous white, the median vittae appearing partly black in some lights. Acrosticals absent; dorsocentrals, 2-3; anterior sublateral and prealar bristles absent; two pairs of strong scutellars, the apical pair decussate; sternopleurals, 1-2, the hair long and coarse. Scutellum brown with the border broadly gray except at the apex. Pleura cinereous pollinose, the mesopleura and upper part of the pteropleura brown or blackish.

Legs black, the basal third of the anterior and two-thirds of the posterior four femora reddish. Posterior femora with a row of anteroventral bristles on the apical half and two or three on the posteroventral surface; all the tibiae with two posterior bristles, the posterior pair with two long anterodorsal bristles medianly; anterior tarsi with apical posterior sensory hairs on each segment.

Wings cinereous hyaline, with the usual three blackish spots. Squamae white. Halteres yellow.

Abdomen black, cinereous pollinose, each segment with a median brown triangle which reaches the base broadly and expands posteriorly to form an apical fascia, which in turn expands to form less conspicuous lateral triangles, the brown markings on the first segment not extending forward in the middle, but emarginate, leaving two short, brown triangles projecting forward; on the fourth segment the posterior brown fascia is narrow and the median vitta less triangular. Lobes of fifth sternite long, rather shining, with bristles apically. Genitalia brownish pollinose.

HOLOTYPE.—Male, Rueru, southwest Miken, Belgian Congo, March 10, 1927, 9500 ft. (J. Bequaert).

This species agrees with *villipes* Malloch in having the pteropleura wholly bare.

### *Idiopygus quadruplex* Stein

*Mydaea quadruplex* STEIN, 1913, Ann. Mus. Nat. Hung., XI, p. 489.

This species is unknown to me, but it is very similar in color to *bequaerti*, new species. However, it has the front femora wholly black and cinereous-pollinose thorax, the mesonotum with four narrow brown vittae. It was described from Abyssinia.

### *Idiopygus villipes* Malloch

MALLOCH, 1921, Ann. Mag. Nat. Hist., VIII, p. 232.

Described from Kenya.

Readily recognized by the wholly black legs and villous anterior and posterior tibiae, the hair being about as long as the tibial thickness.

**Idiopygus ulundi** Malloch

*Idiopygus trochanteratus* MALLOCH, 1921, Ann. Mag. Nat. Hist., VIII, p. 233 (not Stein ?).

*Idiopygus ulundi* MALLOCH, 1922, Ann. Mag. Nat. Hist., X, p. 134.

? *Mydaea trochanterata* STEIN, 1914, 'Voy. Allauad and Jeann.', Dipt., p. 110.

? *Idiopygus trochanteratus* MALLOCH, 1922, Ann. Mag. Nat. Hist., X, p. 134.

This species, if there is only one species possessing the character of wholly black legs and coarsely setose posterior trochanters, will be readily recognized. It seems likely that only one species is represented, but this cannot be definitely determined from the descriptions. Stein described *Mydaea trochanterata* from East Africa, whereas the type of *ulundi* was from Natal. The short spines on the posterior trochanters are stout and bent at a right angle apically.

**Idiopygus trimaculatus** Stein

*Spilographa trimaculata* STEIN, 1906, Berl. Ent. Zeitschr., LI, p. 58.

Black, legs not villous; brown median mesonotal vitta extending over the scutellum. Length, 6 mm.

MALE.—Head white pollinose; frontal vitta wide, dull black; front one-eighth of the head-width; three or four pairs of frontals, the upper ones weak; ocellars long; outer verticals absent. Hair black. Cheeks slightly more than one-fifth as wide as the eye-height. Para-facials about as wide as the third antennal segment. Proboscis, palpi and antennae brown; arista long plumose. Eyes practically bare.

Thorax cinereous-white pollinose, the mesonotum with three broad brown vittae, the median one extending to the apex of the scutellum. Acrosticals absent; dorsocentrals, 2-3; one intra-alar; supra-alar very long; prealar absent; sternopleurals, 1-2, the lower one far from the posterior.

Legs blackish, the femora with thin grayish or pale brownish pollen. Anterior femora with long, bristly hair behind and a row of bristles above and below; middle femora with a row of anterior bristles on the basal half, fine, bristly hairs on the anteroventral surface and an incomplete row of posteroventral bristles; posterior femora with a row of anteroventral bristles which curves upward so as to arise on the anterior surface on almost the basal half, an anterodorsal row of bristles, and two moderately long, coarse spines on the ventral surface, one at the basal fourth, the other near the middle. Anterior tibiae with a weak posterior bristle; middle tibiae with two posterodorsal bristles; posterior tibiae with a long anterodorsal bristle near the middle, a weak posterodorsal

bristle beyond the middle, and three or four bristly hairs on the postero-ventral surface. Tarsi simple.

Wings cinereous hyaline, with brown tinge toward the base, with the usual three brown spots. Squamae white. Halteres yellow.

Abdomen grayish pollinose, the tergites each bearing a very large brownish triangle which reaches the anterior margin and sides and is inclined to be produced forward just under the lateral edges, the triangle more or less divided in the middle on the basal two segments. Hair erect on the first segment, the following segments each with a row of weak discals and row of marginals. Venter cinereous pollinose; lobes of fifth sternite long, with row of long bristles laterally; genitalia brown pollinose.

FEMALE.—Front wide, a whitish triangle in front of the ocelli extending halfway to the antennae; parafrontals rather wide; five pairs of frontals, the upper two pairs reclinate outer verticals weak. Hair of the legs short; spines absent on posterior femora. Abdomen more extensively grayish, the second segment with a pair of dorsal and lateral brown spots, the triangles broadly separated on the second and third segments and strongly expanded to form triangles on the under surface of the abdomen, the fourth segment with median brown vitta and weak lateral spots posteriorly; first and second segments without dorsal bristles, the third with a row of strong marginals, the fourth with a row of strong discals and weak marginals.

Male and female, Burunga, Congo (J. Bequaert); male, Wagira, Gara Mulata, Abyssinia (G. Kristensen).

#### ***Idiopygus hirtiventris* Malloch**

MALLOCH, 1921, Ann. Mag. Nat. Hist., VIII, p. 232.

Described from Nyasaland.

Resembles *trimaculata* Stein but the median dark mesonotal vitta does not extend on to the scutellum, the hypopleura bears some fine hairs below the spiracle and the venter bears conspicuous, rather soft hairs.

#### ***Idiopygus wroughtoni* Malloch**

MALLOCH, 1928, Ann. Mag. Nat. Hist., I, p. 471.

Similar to *hirtiventris* but the hypopleura is bare. The species was described from Natal.





59.57,72 T (6)

FURTHER NOTES ON AFRICAN TRYPETIDAE (DIPTERA) IN  
THE COLLECTION OF THE AMERICAN MUSEUM OF  
NATURAL HISTORY, WITH DESCRIPTIONS OF  
THREE NEW SPECIES

By H. K. MUNRO

The following records deal with the balance of the Trypetidae material submitted to me and of which the Dacinae and certain Ceratitinae were discussed in American Museum Novitates No. 597 (February, 1933). The types of the new species are in The American Museum of Natural History.

*Carpophthoromyia amoena* (Enderlein)

Through an oversight it was not stated that the notes on this species made by me in the previous paper were based on specimens collected at Lukolela, left bank Congo River, 1° 5' S., January 13, 1931 (J. P. Chapin).

*Aciura haematopoda* Bezzi

A female, Addis Abbaba, Abyssinia, July 31, 1920.

According to Hendel this species should be placed in his genus *Metasphenisca*.

*Spheniscomyia binaria* (Loew)

A male, Kamaniola, Belgian Congo, February 1, 1927.

*Pliomelaena bequaerti*, new species

This species seems to be allied to *Pliomelaena caeca* Bezzi, but differs from Bezzi's description in having the frons wider, not narrower than an eye; the proboscis somewhat elongate and geniculate, not short and thick; the thoracic pubescence white, not brown; and the hind crossvein outwardly curved, not straight. In the description of *caeca*, Bezzi states that the stigma is long, but does not state the length; in this species the stigma is about twice as long as its basal width. Further, Bezzi states that in *caeca* the third vein is bristly for its whole length, possibly an incorrect observation; in *bequaerti* it is rather sparsely setiferous to just beyond the upper crossvein.

Both *caeca* and *bequaerti* differ from the other recorded species of *Pliomelaena* in the absence of an apical hyaline spot on the wing, but they may be retained in this genus owing to the general configuration and the bristly third vein. It may here be stated, although not always recorded in descriptions, that probably all species of

*Pliomelaena* have the third vein bristly to some extent. In the description of the genotype, *P. brevifrons*, Bezzi actually states that it is bare. This may be the case in the type specimen; but at any rate, the presence of setulae seems to be variable. In a series of *P. brevifrons* in my collection, one, determined by Bezzi, has a few setulae present at the extreme base only (as may be the case in the type) but in others, among them another specimen determined by Bezzi, there are somewhat weak, scattered setulae present to beyond the upper crossvein.

MALE.—Length of body, 3.9 mm., of wing, 4.0 mm. Head and appendages generally, yellow; length, height, width, 2:3:4; occiput black, broadly yellowish on margins, concave, not prominent below, bristles thickened, whitish; frons at vertex one and one-half times width of eye, narrowed to one and one-seventh as wide at antennae, as long as wide; yellow, with thickened yellow hairs on anterior two-thirds,

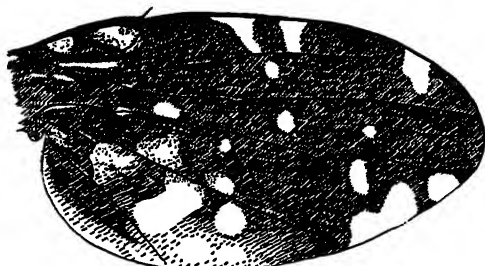


Fig. 1. *Pliomelaena bequaerti*, new species.

ocular dot black, two superior orbital bristles, the upper yellow, three inferior, the lowest yellow and inconspicuous among yellow hairs, ocellars long and strong, brown; lunula short, deeper yellow; antennae darker than head, nearly as long as face, third joint twice as long as wide, upper edge straight, apex rounded, but upper corner almost a right angle; face short, epistome fairly prominent, cheeks and genae narrow, but not linear; oral opening large; proboscis with elongate, hooked labellae which are about as long as haustellum.

Thorax normal (discolored in specimen), black; humeri, upper portion of propleura, and more or less along notopleural suture to wing base, brownish or yellowish; dorsocentral bristles just behind suture, one mesopleural and sternopleural. Scutellum blackish, broadly brownish or yellowish on hind half; four strong bristles of equal length. Legs light brownish. Halteres brownish. Wing (Fig. 1) black, with rather few hyaline spots and indentations, no apical spot, veins black and barely visible, third vein bristly to a little past upper crossvein, costal bristle strong. Abdomen short, reddish black, with black, brown-shining pubescence especially toward apex where abdomen is more reddish; venter and genitalia reddish black.

TYPE.—Male, Paiata, Liberia, October, 1926 (J. Bequaert).

#### ***Euribia tristrigata* Bezzi, 1918**

Several specimens of both sexes, Addis Abbaba, July 5, 1920.

This species should probably be placed in *Paroxyna* Hendel, to which genus most of the African species of *Ensina* (sic. Bezzi) seem to

belong. *E. tristrigata* is possibly allied to the so-called "*dubia*" group, with which it agrees in the similar, but more reduced, wing-pattern, and in having four scutellar bristles of equal length.

***Paroxyna sororcula* Wiedemann**

Two specimens, Addis Abbaba, July 5, 1920, and Djibuti-Addis Abbaba railroad, September 14-17, 1920.

***Paroxyna ignobilis plebeja* (Bezzi)**

Two specimens, Mulata Mts., Harrar Prov., Abyssinia, September 22-25, 1920, and Rueru, southwest Miken, Belgian Congo, March 1927.

***Paroxyna anomalina* (Bezzi)**

*Spathulina anomalina* Bezzi, 1924, Ann. S. Afr. Mus., XIX, p. 536, Pl. xiv, fig. 87.

Two males and two females, Addis Abbaba, Abyssinia, July 31, 1920.

It has always puzzled me why Bezzi placed this species in the genus *Spathulina*. Besides the type, a male, I have two other males, also from Pretoria, that are identical with it. They are characterized by a reticulate pattern much reduced to a few dark spots (at stigma, on each cross-vein, below tip of second vein and at apex of wing, where, too, there is no apical hyaline spot), the reticulation joining the spots being more or less disconnected. Besides these I have a reared series of specimens that agree closely with the type, but the reticulation is slightly more developed and there is a hyaline apical spot; the latter, however, in some specimens has a tendency to disappear. It is with this series that the above four specimens from Addis Abbaba agree.

*Paroxyna anomalina* (Bezzi) is very close to *Paroxyna ignobilis* (Loew), and I am not sure yet just how far they can be considered as distinct species. Typical specimens of *P. ignobilis* and of the variety *plebeja* Bezzi differ in having a paler and more decided and complete reticulation.

***Sphenella marginata* (Fallén)**

Three specimens, Addis Abbaba, Abyssinia, July 18-19, 1920.

***Trypanea hexapoda* Bezzi**

A female, Langatown, Liberia, August, 1926 (J. Bequaert).

The specimen agrees with Bezzi's description, except that there are three inferior orbital bristles, the lowest yellow. The base of the ovipositor is a little longer than the last segment.

***Trypanea bisreducta* Bezzi**

A male, Addis Abbaba, Abyssinia, July 5, 1920.

In Bezzi's tables (1924, Bull. Ent. Res., XV, p. 143) this specimen runs to *Trypanea aira* Walker, but, as I have pointed out (1933, Dept. Agric. S. Afr. Ent. Memoir, VIII, p. 40), Walker's species cannot be recognized. On comparison with South African material, the specimen may safely be regarded as *bisreducta*, being one of those rarer cases in which there are two complete rays across the second posterior cell.

***Acanthiophilus brunneus*, new species**

Very similar to *A. helianthi* Rossi, but with a more pronounced, differently arranged, wing-pattern, shorter stigma and distinctly brownish dust on dorsum of thorax.

**FEMALE.**—Length of body, 5.3 mm., of wing 4.8 mm. Head as in *helianthi*, length about three-fourths height and not quite twice as wide; frons dull yellow, gray on orbits and behind, upper of the two superior orbital bristles yellow, three inferior orbitals, ocellars long; lunule large, semicircular, dull yellow; antennae about four-fifths length of face, upper point of third joint not quite as evident as in *helianthi*; face yellow, cheeks and genae narrow; oral opening wide; labellae short. Thorax normal, black, thickly dusted with Dresden brown, slight median and dorsocentral darker stripes, more blackish on sides and below, sparse white pubescence, dorsocentral bristles just behind suture. Scutellum as thorax, four bristles, apicals short. Legs as in *helianthi*, reddish; wing normal; reduced pattern, stigma and just below, black, terminal spot more or less tending to become reticulate below, but no rays; a slight infuscation over crossveins, and slight irregular reticulation at end of discal cell. Abdomen black, thinly gray-dusted; pubescence black; base of ovipositor shining black, with black pubescence, paler anteriorly, elongate, length 1.0 mm., as long as last five segments of abdomen.

**TYPE.**—Female and two paratype females, Burunga, Congo, 1° 30' S., 29° 18' E., and a paratype female, Addis Abbaba, Abyssinia, August 30, 1920.

***Acanthiophilus griseus*, new species**

A pale brownish species of much the same size and appearance as *Acanthiophilus xiphias* (Bezzi), which was described as a *Euribia*. The type of *xiphias*, also a female, which is in the Hungarian National Museum, Budapest, I have been able to examine through the kindness of Dr. Z. Szilady. The females may be at once distinguished by the great length of the base of the ovipositor in *xiphias*, in which it is as long as the rest of the body, including the head; in this new species it is only as long as the abdomen. In addition, the pubescence on the dorsum of the thorax is golden yellow in *xiphias*, whereas in *griseus* it is white; the pale wing-patterns of both show in the latter a series of three darker spots along the costa, but not in the former.

**FEMALE.**—Length of body, 5.7 mm.; of wing, 5.3 mm. Head of normal shape, dull waxy yellow, occiput darker and ocellar dot black, occipital bristles yellow; frons about one-tenth longer than wide and slightly narrowed to antennae, two-fifths wider than an eye, bristles black, except upper of two superior orbitals yellow, three

inferior orbitals, ocellars strong, very slight whitish pubescence anteriorly and on sides; Antennae three-fourths length of face, darker yellow, third joint rounded at end, second with numerous black setulae; arista brownish at base, flagellum black; face flat, epistome moderately prominent, cheeks one-third and genae as wide as third antennal joint; palpi with black setulae at end; labellae short. Thorax normal, black except yellow below wing base, moderately gray-dusted, pubescence white, bristles blackish, dorsocentrals just behind suture, an extra whitish bristle below the mesopleural and the pteropleural; scutellum as thorax, pubescence longer, almost hairlike, the apical pair of bristles three-fourths length of basals. Halteres yellow; squamae yellowish, earlike. Legs almost chestnut, front femora with a row of yellowish bristles above, and of longer, blackish bristles on lower edge, middle and hind coxae with short row of flattened, yellowish bristles on outer side (not visible on first pair). Wing normal, not as narrow as in *ziphias*; third vein gently bent downward toward its outer end, a single setula on basal swelling; stigma yellow; base of wing hyaline, a faint reticulate pattern on outer half with darker spots on costa, one at costal bristle, one at tip of marginal cell, and one about midway between. Abdomen shining black, with slight gray dust, pubescence yellow, longer than on thorax, base of ovipositor shining black, with black pubescence, elongate, about as long as pre-abdomen.

TYPE.—A female, Addis Abbaba, Abyssinia, August 12, 1920.

#### ***Rhabdochaeta nigra* Bezzi**

A rather small, somewhat teneral specimen, Bakratown, Liberia, October, 1916 (J. Bequaert).

I was fortunately able to compare this specimen with the type, but owing to its poor condition nothing much can be said. In this specimen the white spots in the submarginal and first basal cells appear larger, the third antennal joint rather blackened, and the dorsum of the thorax more uniformly gray-dusted.



59.9.725 E: 14, 71.52

## FRONTAL PROTUBERANCES IN HORSES

## AN EXPLANATION OF THE SO-CALLED "HORNED" HORSE

BY S. HARMSTED CHUBB

Many of those who are associated with or are particularly interested in horses have seen or heard reports of "horned" horses. It is true that occasionally a horse appears with a pair of small protuberances on the forehead above the eyes and a little toward the median line of the skull. Although these protuberances are commonly spoken of as "horns," they should not be associated in any way with true horns, such as we find in the cattle, sheep, goats, and antelopes. While horns are simply modified hair, a dermal growth, with a bone process rising from the skull to support them, the protuberances on horses' foreheads, though composed of bone, never have any suggestion of a horny growth over them but are covered with skin and the usual growth of hair. The occasional development of these abnormalities in horses has attracted considerable attention and prompted a good deal of discussion among scientists as to its cause and possible significance.

The writer has at hand more than a dozen authentic reports of horses having such protuberances. It did not escape the notice of Darwin who, in 'The Variation of Animals and Plants Under Domestication,' (1) published in 1867, wrote as follows: "In various countries hornlike projections have been observed on the frontal bones of the horse: in one case described by Mr. Percival (2) they arose about two inches above the orbital processes, and were 'very like those in a calf from five to six months old,' being from one-half to three-quarters of an inch in length. Azara (3) has described two cases in South America in which the projections were between three and four inches in length: other instances have occurred in Spain."

Lydekker (4) cites a number of examples and gives an illustration of a skull bearing protuberances. The subject also is discussed at some length by Winogradow and Frolov (5), by Cunningham (6), and others.

Mr. Alfred J. Day of Fontwell, England, has kindly sent us plaster casts of the foreheads of two thoroughbred horses, "Domain," four years old, and "The Swamper," two years old, which show very clearly typical



examples of these protuberances. A photograph of one of these casts is shown in figure 1, where it will be seen that the normal growth of hair extends uniformly over the protuberances. The horses from which these casts were taken were under Mr. Day's observation for some time and were described by him in a paper, 'Rudimentary Horns in Horses,' which he has sent me and which he tells me was read by Dr. Eustace (7) before the Linnaean Society of London in June, 1903. He writes as follows: "These animals have rudimentary bosses of bone on the forehead: in the younger of the two animals the breeder informed me when I purchased it that they did not appear until about six months after birth,



Fig. 1. Plaster cast of the forehead of "Domain," a thoroughbred horse four years old, showing frontal protuberances.

It will be seen that the normal growth of hair extends uniformly over the protuberances. Cast presented by Mr. Alfred J. Day.

and in both horses the near or left horn is larger than the right. . . . In the elder horse, "Domain," the left boss is about an inch in length, which has slightly increased during the two years it has been under my observation."

There are on exhibition in the British Museum (Natural History) two skulls as well as Mr. Day's plaster casts, which show conditions practically identical to those so often described.

Although for many years I have been interested in this subject, the present investigation probably would not have been made at this time had it not been for Mr. Day's generosity in giving us these plaster casts,



Fig. 2. Two cases of frontal protuberances.

*A*, a work horse having symmetrical but small protuberances. Owned by Sheffield Farms Company.

*B*, a heavy type horse, thirteen years old, showing protuberances not quite symmetrical, the left, the larger one, being three-fourths inches high. Owned by Borden's Farm Products Company.

*C*, side view of *B*.

and also in sending us reports of other cases that have come under his observation.

Recently I have made a systematic search among the horses of New York City, having examined three thousand one hundred eighty horses, in the hope of finding a few well-defined cases of frontal protuberances and also of establishing an approximate estimate of the percentage of its occurrence.

Here I wish to express my appreciation of the courtesy and kind coöperation shown by many owners of horses, particularly by Mr. Lagerquist of the Sheffield Farms Company, and by Mr. Bates and Mr. Evans of the Borden's Farm Products Company, who have rendered valuable assistance in giving me a free hand in their many stables.

Among this large number of horses examined only five of the much sought abnormalities were found. This is a very small percentage for New York City, but, no doubt, a horse breeding section would show a much higher percentage, as the stock offered in a city market would be more or less selected. In this discrimination, anything that might be regarded as a serious pathological condition or a blemish might cause the individual to be discarded even though the protuberances under consideration would not detract in the least from the practical value of the horse.

The most well-defined case met with is illustrated in figure 2, *B* and *C*, a heavy type of work horse thirteen years old, now in the service of Borden Company. In this case, however, the protuberances are much less prominent than in many of those that have been reported. In another respect this individual is not quite typical, as the protuberance on the left side, which rises three-fourths of an inch above the plane of the forehead, is perceptibly larger than the one on the right. They are located on the frontal bone three and one-half inches apart and three and one-fourth inches from the borders of the orbits.

At one of the many Sheffield Farms' stables visited, a white horse (Fig. 2, *A*) was found with a symmetrical pair of small protuberances. In addition to those figured, three cases were found where the protuberances were equally developed but not sufficiently pronounced to attract special attention.

Although many writers have called attention to these frontal protuberances, so far as I have learned no satisfactory explanation of their occurrence has been offered. There are those who would regard these abnormalities as reversions, a manifestation of the tendency to harp back to some ancestor of the remote past, but, as the evolution of

the Equidae is now well known as far back as *Eohippus* of the Lower Eocene, and as none of the fossil remains shows any indication of "horns," this theory seems hardly tenable. Winogradow suggests that it may be a reversion to a reptilian ancestor, but this would require a strain of the imagination quite unnecessary if there is an explanation near at hand.

Then there are others who would look upon these "horns" as being prophetic and would expect that in ages to come horses will be equipped with these implements, impediments, or ornaments, as the case may be. This theory is difficult to controvert, for who shall say what the appearance of a horse may be only a few million years hence.

But should we not first "seek diligently" for a more tangible explanation? It is true that abnormal enlargements may appear in or under the skin at any part of the body. However, the fact that there seems to be a striking uniformity in the appearance and location of these small protuberances, that they are in the bone, and also that they occur in pairs, would lead one to look for a structural cause for their presence rather than for a pathological condition.

The most hopeful line of investigation, therefore, has been found in the singular behavior of the orbitosphenoid wings of the sphenoid complex in the Equidae, notwithstanding the fact that these wings have their origin at the base of the cranium, while the point of our present interest is at the top of the skull.

The sphenoid complex, in the foetal stage, is one of the bones that is preformed in cartilage, differing in this respect from those cranial bones that are of intermembranal formation. It is one of the few bones of the skull not occurring in pairs, being central and intersected by the median line of the skull. This bone is located in the anteroventral and lateral portions of the cranium, and in the Equidae, as in most of the ungulates, forms a considerable part of the floor and wall of the brain cavity.

The sphenoid complex has a pair of wing-like extensions known as the orbitosphenoids. Each of these orbitosphenoids extends outward and upward along the inside of a part of the frontal bone, with the upper border inserted into a fissure between an inner and an outer wall of the frontal. This bone is best seen in a view of the interior of the sectioned skull of a colt eleven months old (Fig. 3, Specimen No. 38) where the greater part of the cartilage is now replaced by bone, although from a lateral view of the same specimen (Fig. 4, *os.*) smaller parts of the bone can be seen: a narrow strip in the posterior region of the orbit, exposed to view by the removal of the zygomatic arch, and another, exposed by an opening cut in the outer wall of the frontal.

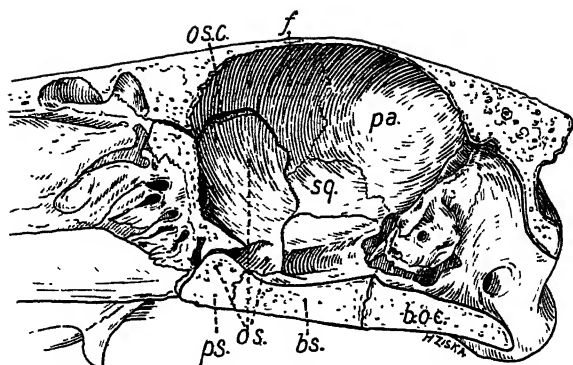


Fig. 3. Median section of the skull of a colt eleven months old, showing interior of brain cavity.

*os.*, orbitosphenoid; *osc.*, part of the cartilaginous portion of the orbitosphenoid where it enters the frontal fissure; *f.*, frontal; *ps.*, presphenoid; *bs.*, basisphenoid; *boc.*, basioccipital; *pa.*, parietal; *sq.*, squamosal; Specimen No. 38.  $\frac{1}{2}$  natural size.

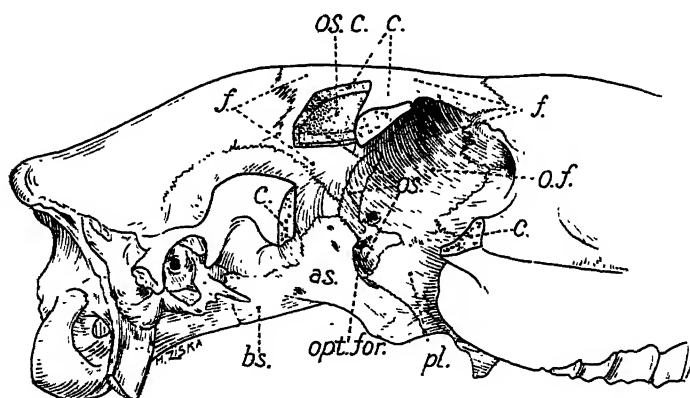


Fig. 4. Lateral view of the skull of a colt eleven months old, with zygomatic arch and section of frontal removed.

*os.*, part of orbitosphenoid where it appears through the narrow opening in the frontal, also its upper portion where it is exposed by the removal of the outer wall of the frontal; *osc.*, that part of the orbitosphenoid which, in the colt, is still represented in cartilage but will later be replaced by bone; *c.*, cut surface of bone; *f.*, frontal; *os.f.*, orbital wall of frontal; *opt.for.*, optic foramen; *as.*, alisphenoid; *bs.*, basisphenoid; *pl.*, palatine. Specimen No. 38.  $\frac{1}{2}$  natural size.

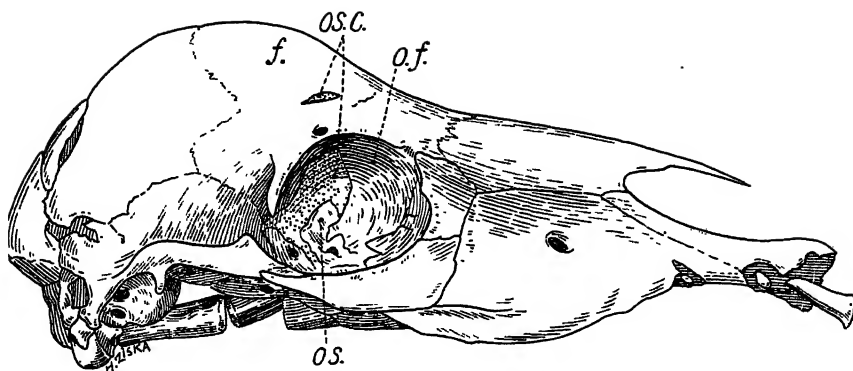


Fig. 5. Foetal skull at an early stage of gestation.

*os.*, bony portion of orbitosphenoid; *os. c.*, cartilaginous portion of orbitosphenoid which will later be replaced by bone; *f.*, frontal; *o.f.*, orbital wall of frontal. Specimen No. 2.  $\frac{2}{3}$  natural size.

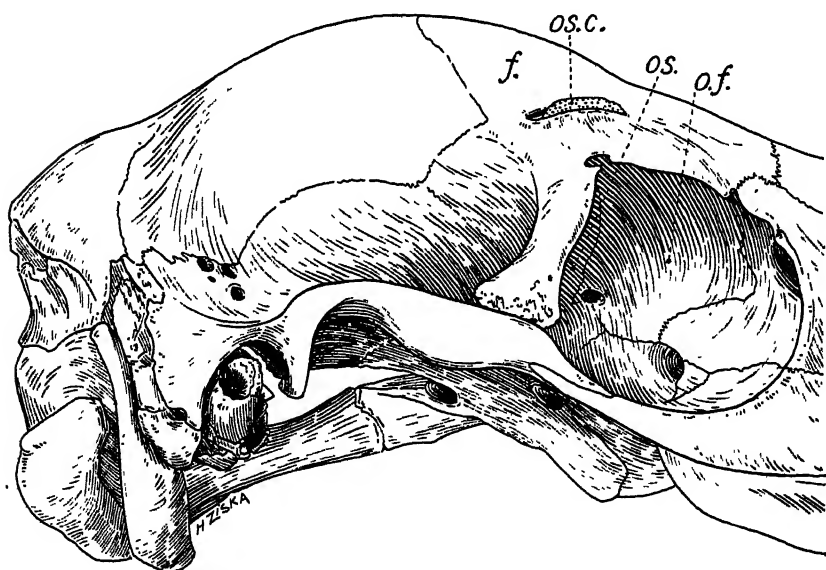


Fig. 6. Skull of a colt five weeks old.

*os.*, orbitosphenoid; *os. c.*, cartilaginous edge of orbitosphenoid protruding through perforation in frontal; *f.*, frontal; *o.f.*, orbital wall of frontal. Specimen No. 34.  $\frac{2}{3}$  natural size.

Now, upon considering an early foetal stage, we find that the central body of the sphenoid begins its calcification while the orbitosphenoid extension still remains represented in preformed cartilage. Soon bone begins to replace the cartilage in the lower portion of the orbitosphenoid, but long before the bone has extended to the upper part a strange development takes place. It would seem that the upward growth of the orbitosphenoid is just a little too rapid for the outside expansion of the growing skull. Consequently, while it is still in soft cartilaginous form, it forces its way into the fissure of the frontal and finally perforates the bone, so that a portion of the cartilaginous edge of the orbitosphenoid appears through the surface of the frontal bone at a point on the forehead corresponding to the position of the so-called "horns," as shown in figure 5.

Although this interesting phase of development appears early in the prenatal stage it continues in a greater or less degree until shortly after birth when, normally, the growing skull overtakes the precocious growth of the orbitosphenoid, leaving its upper edge below the surface of the frontal. Then the perforation fills with new bone and disappears.

It has been said that a tallow candle can be shot through an oak board. I have not tried this interesting experiment but, if true, it would seem no stranger than that soft cartilage should force its way through a much harder frontal bone.

Upon the examination of many specimens it seems that this exciting race in the speed of growth is a close one and, while the frontal has by far the better chance, the finish is never quite certain. During the foetal stage, the lead is sometimes transferred from one to the other in a given individual so that the frontal may be perforated, then filled, and again perforated. Now, if later in the period of colthood, for some reason, the orbitosphenoid should persist in the lead, the natural tendency would be for the frontal bone to build up over the obstruction. Then we would have the phenomenon of a "horned" horse. Indeed, the specimen shown in figure 6, a skull about five weeks old, seems to be approaching this condition. It will be seen that the edges of the perforation, through which the cartilage protrudes, are inclined upward as if in the process of covering the protruding cartilage; and had the colt lived it would, no doubt, have developed a pair of prominences on the forehead. Unfortunately, owing to its curtailed career, it never quite attained the distinction of becoming a "horned" horse.

Referring again to figure 4, where a portion of the outer wall of the frontal bone has been removed, it will be seen that a considerable

portion of the orbitosphenoid is still in cartilaginous form. When the skull is fully grown, this cartilage will have been replaced by bone and the upper border of the mature orbitosphenoid will be only a scant eighth of an inch beneath the surface of the frontal bone. This seems a rather narrow margin of safety by which any individual may escape developing a pair of frontal protuberances that would make him eligible for a "freak show."

In general appearance the orbitosphenoid in the Artiodactyls is similar to that of the Equidae and enters the frontal fissure as in the horse but does not appear to outgrow the frontal, so that there is no competition and no perforation of the frontal bone, so far as I have observed.

For many years I have hoped to procure the skull of a fully mature horse showing these abnormalities. When successful, I feel sure that a careful examination of the frontal region will add even further evidence in support of the above deductions.

It has been shown that the perforation of the frontal bones by the orbitosphenoids is a perfectly normal occurrence during foetal life, that occasionally a slight overgrowth of these wings persists after birth, and that, in such a case, the frontal bones build up ossified material over these parts of the protruding orbitosphenoid wings; thus these prominences become permanent and the so-called "horned" horse results. Frontal protuberances in horses should be looked upon, therefore, not as a reversion to an ancestral type, or as a rudiment of some future development, or even as a pathological condition, but as a result of a peculiar method of construction which, in rare cases, becomes only slightly modified and yet affects the contour of the mature skull.

#### REFERENCES

- (1) DARWIN, CHARLES R. 1900. 'The Variation of Animals and Plants Under Domestication.' New York, I, p. 50.
- (2) PERCIVAL, CHARLES. 1828. 'Horns in the Horse.' *Veterinarian*, August, I, p. 274.
- (3) AZARA, FELIX DE. 1838. 'Natural History of the Quadrupeds of Peru.' London, I, pp. 30-31.
- (4) LYDEKKER, R. 1912. 'The Horse and Its Relatives.' New York, p. 60.
- (5) WINOGRADOW, P. P., AND FROLOW, A. L. 1929. 'Hörnerförmige Bildung auf den Stirnbein eines Pferdes.' *Anat. Anz.*, Bd. 68, pp. 93-94.
- (6) CUNNINGHAM, J. T. 1905. *Proc. Zool. Soc. London*, II, p. 323.
- (7) EUSTACE, DR. G. W. 1903. 'Rudimentary Horns in Horses.' *Proceedings of the Linnaean Society of London*, June, pp. 48-49.





58.9, 61 (68)

PRIMITIVE *ARCHIDISKODON* AND *PALAEOLOXODON* OF  
SOUTH AFRICA<sup>1</sup>

BY HENRY FAIRFIELD OSBORN

Every year brings fresh proof that Africa was the center of the origin and adaptive radiation of the Proboscidea. Since 1907 numerous more or less primitive superior and inferior grinding teeth have been discovered from the Vaal River terraces and other localities of the Transvaal, South Africa. The geologic level and localities are chiefly on the (1) higher and most ancient terrace (200–300 feet) of the Vaal River; (2) middle terrace (60–80 feet) of the Vaal River; (3) lowest and most recent terrace (40 feet) of the Vaal River. Theoretically the lowest terrace may be as old as the lower levels of the middle terrace. Flint implements occur in the middle and lower terraces only (Dart, 1929). In Osborn's opinion the *Archidiskodon subplanifrons*, and *Archidiskodon proplanifrons*, new species, types found in the middle terrace were washed in from an older Pliocene horizon.

Certain of the Transvaal grinding teeth surely belong to very primitive stages of *Archidiskodon*; others probably belong to primitive stages of *Palaeoloxodon* and were originally referred to *Loxodonta*, to *Archidiskodon* and to *Pilgrimia*.<sup>2</sup> Only by careful comparison and analysis is it possible to separate the species belonging to these several genera from each other.

Up to the present time the nineteen species described by W. B. Scott (1907), Raymond A. Dart (1927, 1929), S. H. Haughton (1922, 1932) and H. F. Osborn (1928) are provisionally referred as follows:

<sup>1</sup>This is the thirty-third contribution by the author on the evolution and classification of the Proboscidea.

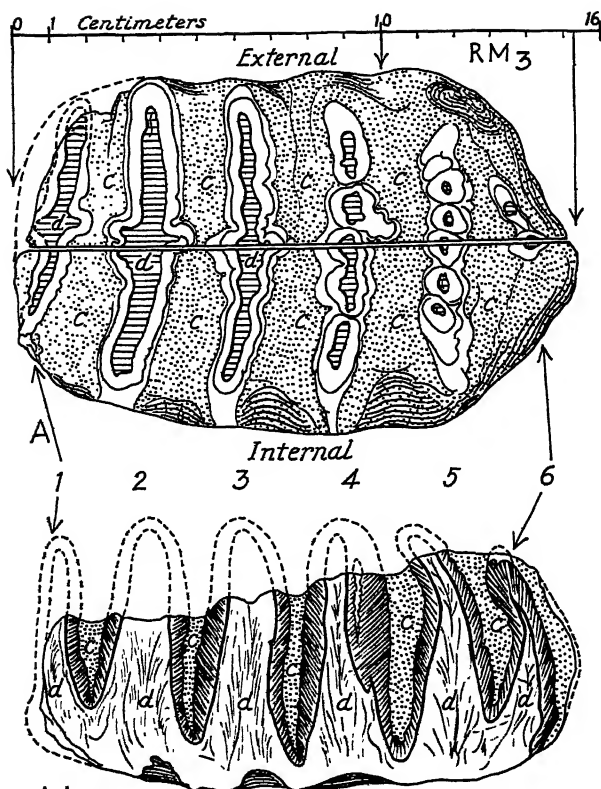
<sup>2</sup>*Pilgrimia* Osborn (December 20, 1924) is antedated by *Palaeoloxodon* Matsumoto (September 20, 1924).

LOCALITY	ORIGINAL REFERENCE	PRESENT GENERIC REFERENCE
Zululand	<i>Loxodon zulu</i> Scott, 1907	= <i>Loxodonta</i>
?Middle terrace, Vaal River	<i>Loxodonta griqua</i> Haughton, 1922	= <b>Metarchidis-</b> <b>kodon</b> , n. g.
Lowest terrace, Vaal River	<i>Archidiskodon transvaalensis</i> Dart, 1927	= <i>Palaeoloxodon</i>
Lowest terrace, Vaal River	<i>Archidiskodon sheppardi</i> Dart, 1927	= <i>Palaeoloxodon</i>
?Middle terrace (lower), Vaal River	<i>Archidiskodon subplanifrons</i> Osborn, 1928	= <i>Archidiskodon</i>
Lowest terrace, Vaal River	<i>Archidiskodon broomi</i> Osborn, 1928	= <i>Archidiskodon</i>
Middle terrace (lower), Sydney- on-Vaal	<i>Archidiskodon vanalpheni</i> Dart, 1929	= <i>Archidiskodon</i>
Middle terrace (lower), Sydney- on-Vaal	<i>Archidiskodon loxodontoides</i> Dart, 1929	= <i>Archidiskodon</i>
Middle terrace (lower), Sydney- on-Vaal	<i>Archidiskodon milletti</i> Dart, 1929	= <i>Archidiskodon</i>
?Middle terrace, Vaal River	<i>Archidiskodon andrewsi</i> Dart, 1929	= ? <i>Palaeoloxodon</i>
Lowest terrace, Vaal River	<i>Archidiskodon hanekomii</i> Dart, 1929	= <i>Palaeoloxodon</i>
Middle terrace, Vaal River	<i>Archidiskodon yorki</i> Dart, 1929	= <i>Archidiskodon</i>
Lowest terrace, Vaal River	<i>Pilgrimia yorki</i> Dart, 1929	= <i>Palaeoloxodon</i>
Lowest terrace, Vaal River	<i>Pilgrimia wilmani</i> Dart, 1929	= <i>Palaeoloxodon</i>
Pniel Estate, ? River	<i>Pilgrimia kuhni</i> Dart, 1929	= <i>Palaeoloxodon</i>
?Recent, Limpopo River	<i>Loxodonta prima</i> Dart, 1929	= <i>Loxodonta</i>
?Recent, Steelpoort River	<i>Loxodonta africana</i> var. <i>obliqua</i> Dart, 1932	= <i>Loxodonta</i>
?Middle Terrace, Vaal River	<i>Pilgrimia archidiskodontoides</i> Haughton, 1932	= <i>Palaeoloxodon</i>
Higher terrace, Vaal River	<i>Pilgrimia subantiqua</i> Haughton, 1932	= <i>Loxodonta</i>

Summing up these species, the ascending geologic level records (Dart, Haughton) are as follows (Table I):

TABLE I.—FAUNAL DISTRIBUTION ON THE RIVER TERRACES OF THE TRANSVAAL

Middle Terrace	Middle terrace, 60-80 feet. Sydney-on-Vaal. ?Lower Pleistocene	Lowest terrace, 40 feet. With flint implements. ?Middle Pleistocene. Bloemhof	Recent—4 feet. Pleistocene
<i>?A. subplanifrons</i> *	Upper levels:	Upper levels:	Levels unknown:
<i>?A. proplanifrons</i> **	<i>A. yorkei</i>	<i>Bubalis bairni</i>	<i>?P. hanekomii</i>
Older than the Upper Pliocene A.	<i>A. broomi</i>	<i>Equus capensis</i>	<i>?L. subaniqua</i>
<i>planifrons</i> of the Siwaliks, India	<i>M. griqua</i>		<i>?P. archidiskodonloides</i>
*actually recorded from a depth of 50-60 feet, middle terrace (60-80 ft.)	Lower levels:	Lowest levels:	Recent:
	<i>P. andreus</i>	<i>P. transvaalensis</i>	<i>L. prima</i>
	<i>A. vernalpheni</i>	<i>P. sheppardi</i>	<i>L. africana</i> var. <i>obliqua</i>
	<i>A. milletii</i>	<i>P. yorkei</i>	
**at a depth of 56 feet, middle terrace, Vaal River	<i>A. losadonloides</i>	<i>P. wilmani</i>	
	<i>Bunalo-phodon</i> ?gen. ?sp.	<i>P. kuhni</i>	



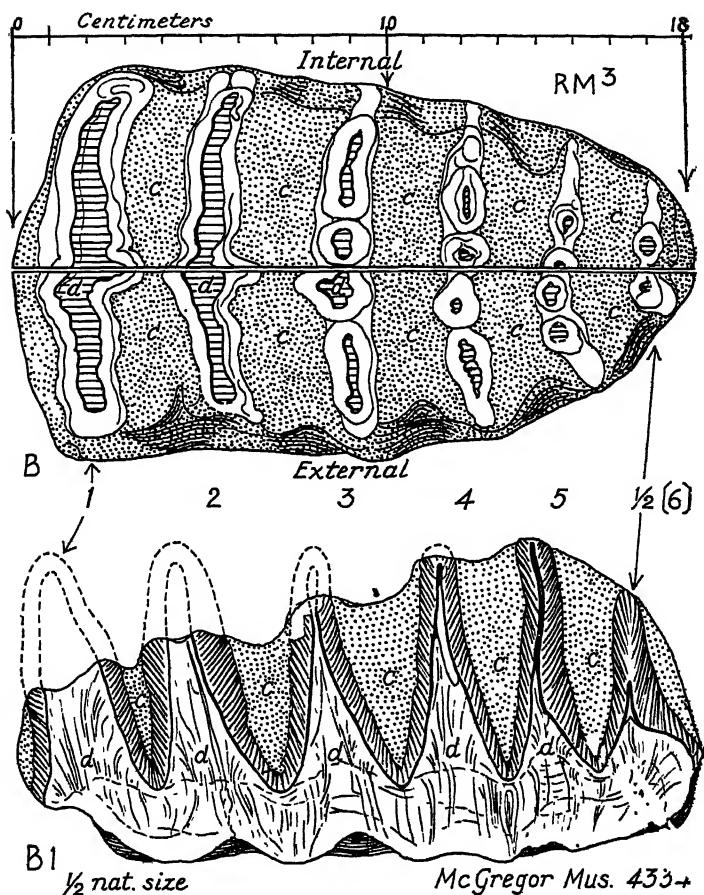
A1  $\frac{1}{2}$  nat. size

McGregor Mus. 3920

Type. *Archidiskodon subplanifrons* Osborn. 1928

Fig. 1. Type, right third inferior molar, RM<sub>3</sub>, of *Archidiskodon subplanifrons* Osborn, 1928, from the middle terrace, Sydney-on-Vaal, South Africa. McGregor Museum 3920, Kimberley, South Africa; cast Amer. Mus. 29124. One-half natural size.

A, crown view. c—cement. d—dentine. Line of midsection. A1, the same in midsection, exhibiting six ridge plates.



Type. *Archidiskodon proplanifrons*. Osborn. 1934

Fig. 2. Type, right third superior molar,  $RM^3$ , of *Archidiskodon proplanifrons*, new species, after original. McGregor Museum 4334, Kimberley, South Africa; cast Amer. Mus. 26969. One-half natural size.

B, crown view showing  $5\frac{1}{2}$  ridge plates, very broad cement areas—c, c, c; six plates represented by two conelets. B1, section of the same showing cement-filled ridge plates more widely open than in *A. subplanifrons*.

By their outstanding characters these species divide into four groups as follows (Table II):

TABLE II.—PROVISIONAL GROUPING OF SPECIES REFERRED TO FOUR TRANSVAAL GENERA

<i>A. subplanifrons</i> group	<i>M. grigua</i> group	<i>P. transvaalensis</i> group	<i>Loxodontia prima</i> group
<p>Crowns very broad, 101 to 114 mm. Enamel very thick. Transverse conelets 4-6 (<i>A. proplanifrons</i>) to 22-24 (<i>A. broomi</i>). Cement enveloping crown. V-shaped cemented valleys at summits broader than dental areas. Loxodont sinus foldings double, less prominent, irregular. The mass of cement exceeds the mass of dentine.</p> <p>Cf. paratype of <i>A. meridionalis</i> Nesti of Val d'Arno, also Brit. Mus. M12641, M12642.</p>	<p>Crowns relatively narrow, 86-94 mm. Enamel thick. Transverse crests 6-8. Cement areas narrower, not enveloping crown. Valleys U-shaped (<i>M. grigua</i>). Post-sinus fold very prominent. Total enamel length unknown. The mass of cement exceeds the mass of dentine.</p> <p>Cf. <i>A. planifrons rumanus</i> Stefanescu.</p>	<p>Crowns of <math>M^3</math> relatively narrow, 70 mm. (<i>P. wilmani</i>) to 110 mm. (<i>P. transvaalensis</i>). Indices = 41 to 51. Enamel relatively thin; conelets finely crimped, i.e. numerous. Cement areas progressively narrower than dental areas. Cemented valleys greatly reduced. Ridge plates narrow and increasingly lofty, 128 mm. (<i>P. wilmani</i>), 259 mm. (<i>P. hanekom</i>). Ridge plates per 100 mm. 4-6. Sinus foldings extremely reduced or progressively wanting. Valleys V-shaped (<i>P. andreus</i>).</p>	<p>Crowns relatively narrow, 74 mm. (<i>L. prima</i>) to 92 mm. (<i>L. subantiqua</i>). Enamel relatively thin, coarsely crimped; conelets numerous. Cement thin in middle, thick at edge. Ridge plates per 100 mm. = 4 (<i>L. africana obliqua</i>) to <math>5\frac{1}{2}</math> (<i>L. subantiqua</i>). Broad typical loxodont sinus expansion, double sinus foldings in contact. Total ridge plates 9 (<i>L. prima</i>) to 12-13 (<i>L. zulu</i>).</p>

TABLE II—Continued

In this group are the following species:	In this group may be the following species:	In this group are the following species:	In this group are the following species:
<i>A. proplanifrons</i> , <i>A. subplanifrons</i> , <i>A. milleti</i> , <i>A. yorkei</i> , <i>A. vanalpheni</i> , <i>A. broomi</i> .	<i>M. grigqua</i> , <i>P. andreusii</i> , <i>A. lozodontoides</i> .	<i>P. [= Pilg.] kuhni</i> , <i>P. [= Pilg.] yorkei</i> , <i>P. [= Pilg.] wilmani</i> , <i>P. archidiskodonoides</i> , <i>P. sheppardi</i> , <i>P. transvaalensis</i> and <i>P. hanekomii</i> . Also possibly <i>P. andreusii</i> . These seven or eight types are much more uniform in character than members of the <i>M. grigqua</i> group, <i>P. sheppardi</i> and <i>P. transvaalensis</i> formerly being referred by Dart to <i>Archidiskodon</i> . <i>P. kuhni</i> , <i>P. yorkei</i> and <i>P. wilmani</i> were referred by Dart to <i>Pilgrimia</i> ; the prevailing characters relate them more closely to <i>Palaeolorozodon</i> .	<i>L. zulu</i> , <i>L. [= Pilg.] subaniqua</i> , <i>L. africana obliqua</i> , <i>L. prima</i> . These occur only on the more recent levels and are clearly related to the existing African elephant, distinguished by the above characters.
The ridge plate height increases from 55 in <i>A. proplanifrons</i> to 62 e. in <i>A. subplanifrons</i> , to 118 in <i>A. milleti</i> , to 129 in <i>A. vanalpheni</i> and 110+ in <i>A. broomi</i> . Meanwhile the number of ridge plates in 100 mm. remains constant, namely, 3 in <i>A. proplanifrons</i> , $4\frac{1}{2}$ in <i>A. planifrons</i> of India and 3 in <i>A. broomi</i> .	The generic relationships of this group are doubtful; the narrow crowns separate the types of <i>M. grigqua</i> and of <i>P. andreusii</i> from the broad crowns of the typical <i>Archidiskodon</i> . The U-shaped valley of <i>M. grigqua</i> of Fig. 3 is quite distinct from the V-shaped valley of <i>P. andreusii</i> ; similar teeth have been discovered in Europe. It is probable that these teeth represent a genus distinct either from <i>Archidiskodon</i> or <i>Palaeolorozodon</i> , namely <i>Metarchidiskodon</i> .		



The above phylogenetic arrangement is provisional. Only by the longitudinal sectioning method of Falconer is it possible to ascertain the true structural relationships of these Proboscidean molars. This is illustrated in the wide difference between sections of *M. griqua* (Fig. 3)

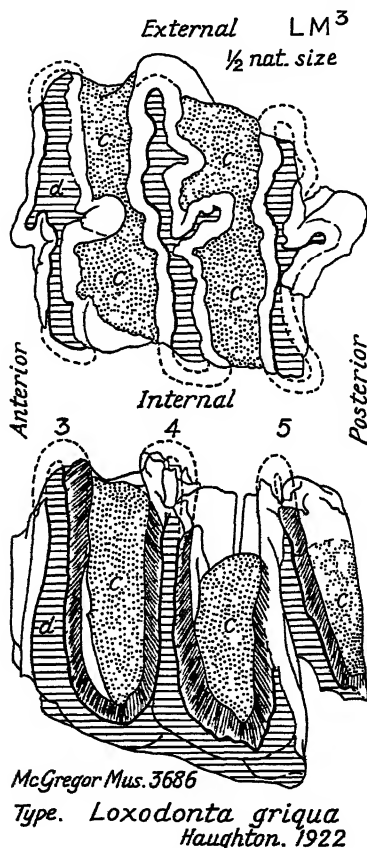


Fig. 3. Type of "*Loxodonta*" *griqua* Haughton, 1922. McGregor Museum 3686, Kimberley, South Africa. Supposed third, fourth and fifth ridge plates of an LM<sup>3</sup>. Observe very deep U-shaped valleys, thick simply folded enamel with very prominent looped post-sinus folds. Type figure of *Metarchidiskodon*, new genus. One-half natural size.

and *P. andrewsi* (Fig. 5), also in the wide difference between the sections of *A. subplanifrons* (Fig. 1) and *A. proplanifrons* (Fig. 2). A very interesting comparison is that of the *planifrons* series of Africa and the Siwaliks of India analysed as follows (Table III):

TABLE III.—COMPARATIVE MEASUREMENTS OF THE PRIMITIVE SPECIES OF *Archidiskodon*  
FROM THE TRANSVAAL AND FROM THE UPPER SIWALIKS OF INDIA

	Tooth	Ridge plate height	Number of ridge plates	Ridge plates per 100 mm.	Enamel thickness	Loxodont sinus and folds	Conelets and crimping	Length	Breadth	Index	Enamel length
<i>A. proplanifrons</i>	RM <sup>3</sup>	55	5½-6	3	5	Pre- and post sinus 4-6. folds	Conelets = 4-6.	179	104	58	690
<i>A. subplanifrons</i>	RM <sub>3</sub>	62e.	6	4	4	Pre- and post sinus 6-8. folds.	Conelets = 6-8.	153	101	66	650
<i>A. planifrons</i> *	RM <sub>3</sub>	55	8e.	4½	3½	Pre- and post sinus 16 e. in folds, ridge plate greatly reduced.	Conelets = 16 e. in folds, ridge plate greatly reduced.	179	86	48	810e.

\*This is No. 19965, American Museum Brown Collection (Fig. 4) from near Siawan, India. This is the most primitive stage found in the large series of the *Archidiskodon planifrons* molars collected by Barnum Brown in the Upper Pliocene Pinjor horizon of the Siwaliks, India.

*A. proplanifrons* proves to be by far the most primitive elephantoid thus far discovered; the types of *A. subplanifrons* and of *A. proplanifrons*, although recorded from the middle terrace, were probably washed from older Pliocene deposits into the Pleistocene terrace gravels. Both types are much more primitive than the most primitive molars thus far discovered by Falconer and Barnum Brown in the Upper Pliocene Siwaliks of India.

#### **Archidiskodon subplanifrons group**

The author owes the present rare opportunity to revise his own previous opinions and those of Houghton and Dart to the courtesy and confidence of Curator Wilman of the McGregor Museum in Kimberley, South Africa, who forwarded the original fossil types of *A. subplanifrons* (Fig. 1) and *P. andrewsi* (Fig. 5), enabling us to distinguish ancestral *Palaeoloxodon* from ancestral *Archidiskodon*. First, let us briefly review and expand the characters of the first-mentioned species:

#### **Archidiskodon subplanifrons Osborn, 1928**

Type: Right third inferior molar, five ridge plates exposed, sixth buried in cement, ridge plate 1 imperfect. McGregor Museum 3920, cast Amer. Mus. 21924.

Length of type molar = 153 mm., breadth = 101 mm., index = 66.

Enamel length, restored = 650 mm., enamel area = 2600 sq. mm.

Average enamel thickness = 4 mm.

Ridge plates, number = 6, postconvex, preconconcave, 5-6 suboval to round conelets with double central folds in the ridge plate.

Ridge plates per 100 mm. = 4.

Erroneously referred by Houghton (1932, page 2) to *Archidiskodon subplanifrons* is the much more primitive specimen (McGregor Museum 4334), herewith made the type of *Archidiskodon proplanifrons*.

#### **Archidiskodon proplanifrons, new species**

Type: Third superior molar of the right side with six complete ridge plates. McGregor Museum 4334, cast Amer. Mus. 26969.

Recorded from Gong-Gong "at a depth of 56 feet in the 'Middle Terrace,' under a boulder, at a distance of 450 yards from the Vaal River, thus occurring at a depth of from 10-15 feet below the level of the present river bed."<sup>1</sup>

Length = 179 mm., breadth = 104 mm., index = 58.

Height of 5th ridge plate = 55 mm.

Enamel length, restored = 690 mm.

Average enamel thickness = 5 mm.

Ridge plate, number = 5½-6. Postconconcave, preconconvex, with 4-5 rounded conelets in the posterior plates and 6-6+ conelets in the anterior plates, slight median foldings in each transverse plate.

---

<sup>1</sup>Houghton, 1932, page 2.

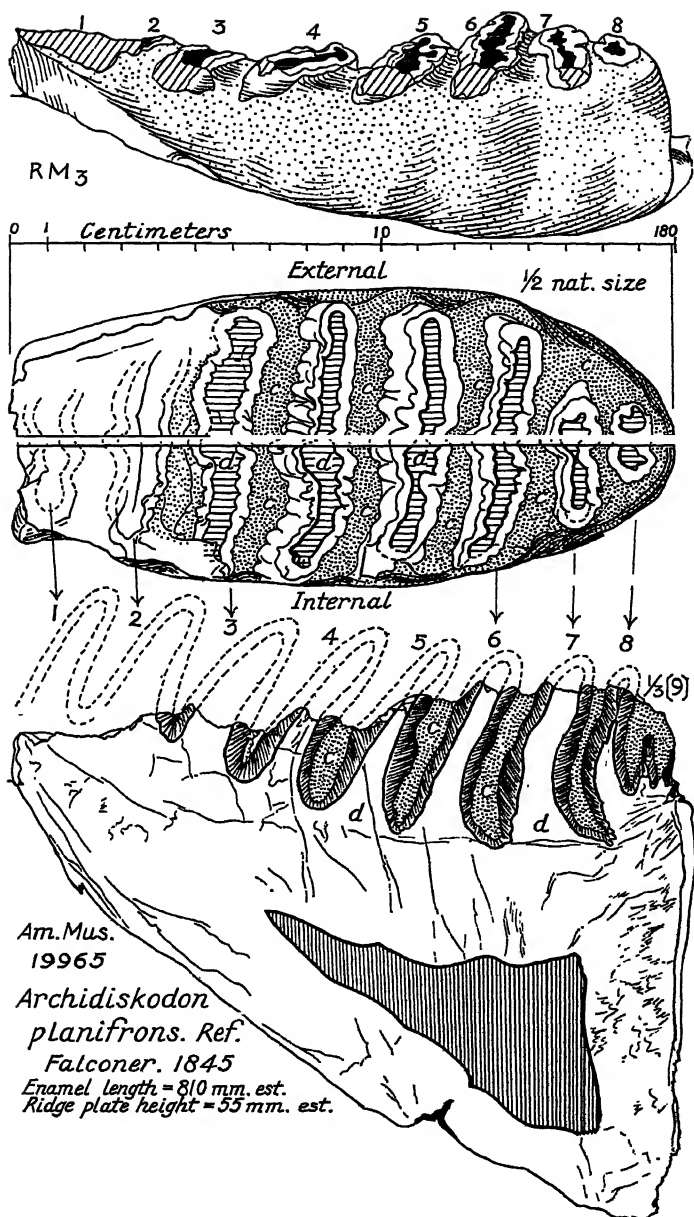


Fig. 4. Referred third right inferior molar, RM<sub>3</sub>, of *Archidiskodon planifrons* Falconer, 1845, from three miles north of Siswan, India. 8 1/3[9] ridge plates. Internal aspect exhibiting the gently folded section of the entire molar with relatively low enamel ridge plates and estimated total enamel length of 810 mm. One-half natural size.

According to these measurements by Osborn, 1934, and those of Haughton, 1932, this type third right superior molar is the most primitive elephant tooth thus far discovered, even more primitive than *Archidiskodon subplanifrons*; it is indubitably an ancestral *Archidiskodon* with widely open valleys, summits of ridge plates much more widely separate than in *A. subplanifrons*, cement bathing the entire surface of the crown, median pair of conelets entirely distinct and undivided, total number of conelets estimated in the crown 26, as compared with total estimated number 34 in *A. subplanifrons*.

The above species, *Archidiskodon subplanifrons* Osborn, 1928, and the new species *Archidiskodon proplanifrons*, as tested by these thickly enameled, deeply cemented, low and spreading ridge plated, relatively broadened, third superior and inferior grinding teeth, are totally distinct from certain of the relatively thin enameled, high ridge plated, less deeply cemented, relatively narrow molar types which have been erroneously referred by Haughton, Dart and Osborn to *Archidiskodon*, but more properly belong to *Palaeoloxodon* including its synonym *Pilgrimia*.

#### **Metarchidiskodon griqua group**

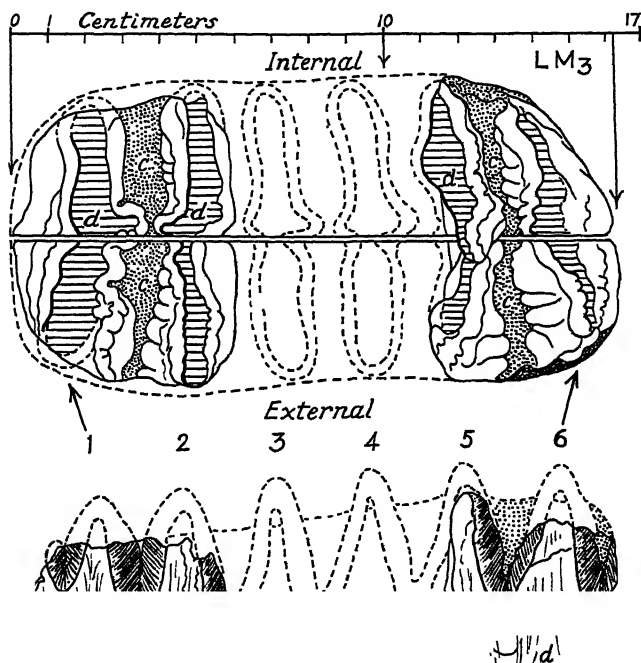
##### **Metarchidiskodon, new genus**

This group includes the fragmentary type (Fig. 3) of "*Loxodonta*" *griqua* Haughton, 1922, in which we observe the following distinctive characters: (1) Cement areas equal or exceed dentine areas; (2) pre-sinus folds absent or inconspicuous; very prominent post-sinus folds; (3) very deep U-shaped valleys extending to the bottom of the crown; this is a very important point. (4) These valleys are filled to the summit with cement. (5) Enamel ridge plates very deep, extending to the bottom of the crown, closely compressed with very narrow dentinal areas between.

This specimen appears to belong to a distinct form of grinding tooth to which the new generic name *Metarchidiskodon* may be applied, and distinguished from *Archidiskodon* as follows: (1) M3 with a relatively long narrow crown; index cannot be estimated at present. (2) Deep U-shaped valleys filled with cement. (3) Enamel ridge plates extending to the bottom of the crown. (4) Very prominent post-sinus folds instead of median sinus expansion of the typical *Archidiskodon* (Figs. 1, 2, and 4). Type species: *Loxodonta griqua* Haughton, 1932. Type figure 3, to be compared with the relatively narrow grinding teeth of similar molars observed in the Val d'Arno specimens and in British Museum M12641, M12642.

**Palaeoloxodon transvaalensis group**

The sectioned fragments of the type LM<sub>3</sub> (McGregor Museum 435) named *Archidiskodon andrewsi* by Dart in 1929, differ very widely both from the sectioned grinders of "*Loxodonta*" *griqua* just described in the relatively shallow enamel folds which are V-shaped and penetrate to only half the depth of the grinder as a whole.



$\frac{1}{2}$  nat. size

McGregor Mus. 435

Type. *Archidiskodon andrewsi*. Dart. 1929

Fig. 5. Restored type of "*Archidiskodon*" *andrewsi* Dart, 1929, McGregor Museum 435, Kimberley, South Africa; cast Amer. Mus. 26968. Crown view restored with estimated  $6\frac{1}{2}$  ridge plates. Observe subequal cement and dentinal areas; pre- and post-sinus folds and two anterior ridges in contact; sharply V-shaped valleys between enamel ridges which penetrate about half the crown, thus differing widely from the enamel ridge plates of *A. subplanifrons*. This is provisionally referred to *Palaeoloxodon*. One-half natural size.

?PRIMITIVE *Palaeoloxodon*.—A primitive or ancestral member of the *Palaeoloxodon* group may be this problematic *A. andrewsi* Dart (Fig. 5), a type which on sectioning and very careful reëxamination by the present author, proves to be distinct both from *A. planifrons* (Fig. 4) and *A. subplanifrons* (Fig. 1). The fragmentary type, f.LM<sub>3</sub>, displays the following characters: Ridge plate height = 48 mm. est., estimated number of ridge plates = 6. Feeble pre-sinus fold; very prominent post-sinus fold. Valleys V-shaped. Estimated length = 164 mm. Estimated breadth = 83 mm., estimated index = 50. Enamel thick, crimped. It has been extremely difficult to restore this terribly shattered type specimen and deduce its outstanding characters as listed above, from the enamel folds which certainly belong at the front and back of the third inferior grinding tooth.

TYPICAL *Palaeoloxodon*.—The type molars of the eight species referred to *Palaeoloxodon* above are readily distinguished from *Archidiskodon* by the following five characters: (1) Dentine areas equal or exceed cement areas by relatively close compression of the ridge plates. (2) Absence of pre- and post-sinus central foldings, faint median expansion of the loxodont sinus. (3) Enamel relatively thin and more or less strongly and finely crimped. (4) Height of ridge plates increasing: *P. kuhni* = 100 mm., *P. wilmani* = 128 mm., *P. archidiskodontoides* = 145 mm., *P. sheppardi* = 188 mm., *P. transvaalensis* = 231 mm., *P. hanekomii* = 259 mm. (5) Number of ridge plates. It seems probable that Dart's type of *A. sheppardi*, displaying 1-13 ridge plates, is an LM<sup>2</sup>, in which case *A. sheppardi* becomes a synonym of *A. transvaalensis* Dart with 1-14 ridge plates.

#### CONCLUSION

The present author trusts that this statement of his own errors in treating members of this group together with the introduction of the section method of Falconer may facilitate the reëxamination and fresh interpretation of the generic and phylogenetic relations of these very important Transvaal types.

## BIBLIOGRAPHY

- DART, RAYMOND, A. 1927, "Mammoths and Man in the Transvaal." Supplement to Nature, No. 3032, Dec. 10, pp. 41-48, text figs. 1-7.
1929. "Mammoths and Other Fossil Elephants of the Vaal and Limpopo Watersheds." South African Journal of Science, XXVI, December, pp. 698-731, text figs. 1-28.
- HAUGHTON, S. H. 1922. "A Note on Some Fossils from the Vaal River Gravels." Trans. Geol. Soc. South Africa [for the year 1921], XXIV, pp. 11-16, Pl. I.
1932. "On Some South African Fossil Proboscidea." Trans. Roy. Soc. South Africa, XXI, Part 1, pp. 1-18, Pls. I-IV, text figs. 1-8.
- OSBORN, HENRY FAIRFIELD. 1928. "Mammoths and Man in the Transvaal." Nature, CXXI, No. 3052, April 28, pp. 672-673, text figs. 1, 2.
- SCOTT, WILLIAM B. 1907. "A Collection of Fossil Mammals from the Coast of Zululand." Third Rept. Geol. Survey Natal and Zululand, May, 1907, pp. 253-262, Pls. XVI-XVIII.





## TWO NEW MAMMALS FROM KAZAKSTAN

BY GEORGE G. GOODWIN

The following descriptions are published in advance of a report on mammals collected in 1929 for The American Museum of Natural History by the Morden Graves North Asiatic Expedition. A detailed account of the collection will be given later.

***Crocidura suaveolens mordeni*, new species**

TYPE.—No. 85315, Amer. Mus. Nat. Hist., female, adult; Tuz Bulak, altitude 600 feet; 150 miles north of Kizil Orda (Perovsk), Kazakstan, Central Asia; October 21, 1929; collector, George G. Goodwin. The type is a skin and skull in good condition.

GENERAL CHARACTERS.—A small pale-colored white-toothed shrew about the size and general proportions of *Crocidura lignicolor* Miller, but color paler, under parts nearly pure white, this color extending well up over sides of body and face; tail relatively long, distinctly bicolor, the line of demarcation sharply indicated.

DESCRIPTION.—Pelage moderately long and soft. Color of upper parts including upper surface of tail uniform, between verona brown and wood brown; fore and hind limbs and feet, lips, cheeks to eye, base of ear, and entire under parts white, lightly washed with pale buff. The dorsal area in the six paratypes varies in color from verona brown to pale wood brown, but under parts throughout the series are white. Skull about the size and general proportions of *Crocidura lignicolor*; the length of the upper tooth row averages slightly longer than in typical specimens from Djarkent, Eastern Turkestan, but general characters essentially the same.

MEASUREMENTS OF TYPE.—Taken in the flesh: total length, 90 mm.; length of tail vertebrae, 30 mm.; hind foot, including claws, 12.5 mm. Skull: condylobasal length, 16.8 mm.; least interorbital breadth, 4 mm.; greatest breadth of brain case, 8.2 mm.; length of entire maxillary tooth row, 7.9 mm.

*Crocidura s. mordeni* can readily be distinguished from *Crocidura lignicolor* by its white under parts and more sharply bicolor tail. I have not compared it with *Crocidura ilensis* Miller from Ili, but from the type description it differs in color, smaller feet, and some cranial characters. The type and six paratypes were taken in the open steppe country and in narrow ditches at the foot of an escarpment where the water from springs trickled down and dried up on the desert. Two specimens were taken at Tele Kul, sea level, in the flat, alkali lake district.

**Microtus gravesi**, new species

TYPE.—No. 85322, Amer. Mus. Nat. Hist.; male, adult; Tuz Balak, altitude 600 feet, 150 miles north of Kizil Orda (Perovsk), Kazakstan, Central Asia; October 21, 1929; collector, George G. Goodwin.

GENERAL CHARACTERS.—A small light-colored vole with a short tail, small ears but not concealed in the fur; bullae much inflated; externally very similar to *Phaiomys blythi* from Ladak, India, but smaller, with relatively shorter tail, smaller feet, and widely different cranial characters. Fur long and soft, underside of feet moderately overgrown with hair, but toes and foot pads naked.

DESCRIPTION.—Color of upper parts: hair pinkish buff subterminally; tips dark brown, darkest on posterior dorsal area; fore and hind feet buffy white; tail indistinctly bicolor, light buff with a weak middle dusky stripe along the dorsal surface. Under parts light buff, the plumbeous basal color showing through. Skull angular and broad, with two low, distinct bow-shaped middle or lateral crests. Audital bullae large, their walls strengthened by dense, spongy bone tissue, inflated, and forming prominences on the sides of the occiput; interorbital area narrow, expanding abruptly posteriorly. The last upper molar with four well-developed projecting angles on inner side. The dorsal surface of the skull resembles Vinogradov's figure of *Phaiomys bucharensis* in his 'Key to the Rodents of Middle Asia,' but differs in having four well-developed projecting angles on inner side of last upper molar instead of three as designated for *Phaiomys* by Dr. Vinogradov.

MEASUREMENTS OF TYPE.—Taken in the flesh: total length, 120 mm.; length of tail, 25 mm.; hind foot, including claws, 18 mm. Skull: condylobasal length, 26 mm.; zygomatic breadth, 15.5 mm.; least interorbital breadth, 3.4 mm.; mastoid breadth, taken just behind the auditory meatus, 12.6 mm.; length of nasals, 7.5 mm.; length of anterior palatine foramina, 4.25 mm.; aveolar length of upper molar series, 6.2 mm. Besides the type there are four paratypes, three skins and skulls, and one alcoholic specimen.

This vole was taken in scattered clumps of grass near small springs that trickled down the side of an escarpment and dried up on the sand. It was active most of the day and lived in holes or burrows in the ground and fed on the succulent bases of the grasses. Apparently it is rather local and not very abundant. It was difficult to trap and two of the five specimens I caught with my hands.





59.57.99 A (7)

NEW SPECIES AND SUBSPECIES AND ADDITIONAL  
RECORDS OF NORTH AMERICAN ANTHIDIINAE

BY HERBERT F. SCHWARZ

In the present paper a few forms believed to be new are described, and some old forms are listed and discussed.

***Anthidium rodecki*, new species**

MALE.—Black, conspicuously ornamented with massive pale yellow bands.

Head much broader than long. Eyes, very slightly converging below, of a light yellowish-green traversed vein-like by irregular thin lines of still lighter yellow, giving a slightly mottled effect; frequently a patch of deeper color near the top of the eye. The mandibles except for the teeth, the entire clypeus except for a narrow edging of black to reddish brown along the apex, the sides of the face completely to the level of the base of the antennae, frequently a narrow, more or less interrupted, transverse band contiguous to the clypeal maculation in the supradypeal area, a broad stripe from base to apex on the scape in front, and a conspicuous band (straight posteriorly but of undulating outline anteriorly) extending from slightly above the apex of one eye across the vertex to slightly above the apex of the other eye and broadest just above the middle ocellus—all pale yellow. The hair silvery gray to white, longest on the clypeus, on the lateral brushes of the scape, and on the vertex. The mandibles tridentate: the outermost tooth long, conspicuous, and finger-like, the intermediate tooth small and short, the innermost tooth short but broad. The apical margin of the clypeus rather straight, barely or not at all impressed toward the middle. The punctation of the clypeus and sides of the face dense but relatively fine, that on the front usually more or less concealed by the hair, that in the black space between the lateral ocelli and the eye relatively fine and rather distinct when compared with that of species like *tenuiflorae*, *emarginatum*, *mormonum*, etc.

The thorax with the following pale yellow maculations: tubercles, tegulae except for the large brown pupil, usually L-shaped marks bordering the sides and anterior margin of the mesonotum, the arms of the L being subequal in length but of unequal thickness, the anterior arm being more massive than the lateral one and surviving even when the lateral arm is missing, the axillae and scutellum except for a subtriangular area of black on the scutellum that drives a broad wedge into what would otherwise be a continuous maculation. The mesonotum and mesopleura densely but not especially coarsely punctured, the scutellum with less crowded punctures. The propodeum tessellate, with a broad transverse band of superimposed, very shallow and faint punctures along the base and with a similar punctate-tessellate area to each side of the rather funnel-shaped hairless area at the middle. The hair of the thorax silvery gray to white and rather long.

The legs with pale yellow maculations on the following parts: well-developed stripes on the under side of the front and middle femora, the hind femora with only an abbreviated stripe or wholly without a stripe, the entire outer surface of all of the tibiae, the tibial spurs of the middle and hind legs, the outer and inner surface of the basitarsi, with splashes of pale yellow also on the adjacent tarsal joints of the middle and hind legs. The tarsal joints otherwise reddish brown. The claws light ferruginous on their basal half, of a dark but still transparent red on their apical half, deeply cleft, but the inner element somewhat shorter than the outer. The hair silvery white to white except for pale golden hairs on the under side of the front basitarsi; there are reddish spines arranged in a comb at the apex of the hind basitarsi and at the apex of the subsequent tarsal joints.

The wings rather clear, the marginal cell with a faint brownish stain in its anterior half. The venation fuscous with a tendency to become more reddish brown as the tegulae are approached.

The abdomen with very broad, conspicuous, pale yellow bands: that on tergite 1 occupies all of the dorsal surface except the apical rim and a narrow median interruption; those on tergite 2-5 extend uninterruptedly across the tergite and are without emargination except for a small V-shaped area above at their middle. The band on these four tergites is of slightly increasing breadth from tergite to tergite and is bounded apically by the depressed, dark to sometimes reddish rims, and basally by a subequal area of black. Tergite 6 is wholly yellow except for a narrow black basal area, the abbreviated apical rim, and reddish transparent tip and outer lateral border of the lateral spines; the pygidium is yellow except for a narrow border of black laterally and apically on the lateral lobes and except for the black tip of the median spine. The lateral lobes are short and broad, barely or not at all extending beyond the median spine, and slightly rounded to subtruncate at the apex. The width of each lobe at the apex is about twice the distance separating the inner margin of the lobe from the median spine. The punctation of the tergites is fine and sparse, particularly so at the base of the several tergites; on the apical rims the punctation tends to arrange itself more or less in chainlike groupings and, while the punctures within each chain sometimes crowd like beads, a distance equivalent to one or more punctures usually separates one chain from another. The hair of the abdomen is silvery gray to whitish, abundant and long on tergite 1 and on the venter, sparser on the other tergites, absent from the rims.

Apical segments in all cases curved under the abdomen, but average length probably 10 mm. to 12 mm.; width of thorax 4 mm. to  $4\frac{1}{2}$  mm.; length of fore wing, including tegula, 7 mm. to 8 mm.

**FEMALE.**—Maculated very much like the male on the thorax, legs, and abdomen, but the head devoid of maculation except for a stripe extending from the summit of the eye to just above the nearest ocellus. The mandibles of the usually multidentate type; the apex of the clypeus without rugosities; a vague carina bisecting the densely punctate clypeus longitudinally. The hair of the head gray; the clypeus hairless (possibly due to wear) except on its lower lateral edges.

The L-shaped thoracic stripes discontinuous (probably, as in the male, a variable ornamentation); the other thoracic maculations, color of hair, and sculpturing as described for the male.

The yellow area covering the outer surface of the tibiae terminates just before the apex of the joint. A dense patch of snow-white hairs conceals the external surface of the front and middle basitarsi, but on the basitarsi of the hind legs the hairs are thinner and this surface reveals itself as maculated with yellow nearly to the tip. The front and middle femora have a stripe on the under side but not the hind femora (probably as in the male a variable maculation). The hair silvery white to white except for the rich reddish-golden to copper-brown hairs on the under side of the tarsal joints.

The pale yellow or cream-colored stripes on tergites 1-5 as described for the male. Tergite 6 yellow, except for invasions of darker color on each side at the base. An obtuse angle or shoulder at each side of the apex of tergite 6 interrupts an otherwise curvilinear contour. The rim of this tergite distinct although not as long as the rim of the previous tergites. Ventral scopa silvery white.

In its maculations, in the coloration of its eyes, and to a large extent also in its punctation the male of the present species closely resembles the male of *Anthidium rohweri* Schwarz, but the structure of the pygidium and of the last ventral segment are wholly different from the corresponding parts of *rohweri*. Even the maculations do not show complete accord. Thus in *rodecki* the band on the vertex is broadest at its middle, in *rohweri* distinctly narrowed at the middle; the heavy maculation that covers most of the axillae and scutellum is definitely divided into two halves by the median emargination in *rodecki*, whereas in *rohweri* the somewhat smaller maculation is uninterrupted. The bands on the abdominal tergites of *rodecki* are not quite so broad as the especially wide bands on the tergites of *rohweri*, but the V-shaped emarginations above on the middle of these bands cut deeper into these bands in *rohweri* than they do in *rodecki*, sometimes even completely dividing them. The bands are deep yellow in *rohweri*, pale yellow in *rodecki*.

The superficial resemblance of the male of *rodecki* to the male of *edwardsii* Cresson is likewise rather close. Again, however, the structure of the pygidium and of the last visible ventral segment of *rodecki* bear no resemblance to the corresponding parts in *edwardsii*. The presence of merely a small maculation above each eye in *edwardsii* instead of a band across the vertex as in the male of *rodecki*, the deeper yellow and somewhat greater breadth of the bands on the abdominal tergites of *edwardsii*, and the ferruginous pygidium of this species contrasted with the pale yellow pygidium of *rodecki*, all contribute to make the distinction between the two species clear-cut.

The above descriptions are based on a series from Roggen, Colorado. Six of the specimens (all males) were taken at the locality by H. G. Rodeck, July 17, 1930, and a seventh (likewise a male) by the same collector on July 26, 1930. Seven additional specimens—six of them



males and only one a female—with date of July 8, 1933, bear on the label three names: M. and H. James, Louise Ireland.

***Anthidium mormonum hicksi*, new subspecies**

Differs from typical *mormonum* and other subspecies of *mormonum* in having rather close to the inner margin of each compound eye, and on a level only slightly below the anterior ocellus, a rounded yellow spot of variable size. In addition, the band behind the ocelli is continuous in two of the three specimens on which this description is based and is virtually continuous in the third.

Of a total of five females collected in their immature stages at Pasadena, California, and reared to maturity by Dr. Charles H. Hicks, in whose honor the subspecies is named, three share the unusual maculation indicated. Each of these females bears a separate field number and belonged to an individual nest, although the collecting site—to be described at some future time by Dr. Hicks—was the same for all five.

A male with a field number identical with that of one of the female paratypes of *hicksi* lacks the characters that distinguish the female.

Of the two females that do not conform to the above description one has a character unusual in *Anthidium*, being more characteristic of *Heteranthidium* and *Hypanthidium*; namely, the presence of two short, narrow, longitudinal, and virtually parallel stripes near the middle of the mesonotum (see reference to a specimen of *Paranthidium jugatorium* subspecies *lepidum* commented on elsewhere in this paper). A male of identical field number which accompanies this aberrant female of *Anthidium mormonum* is not characterized by this exceptional maculation.

***Dianthidium parvum heteropoda*, new subspecies**

FEMALE.—Like typical *parvum* but the flagellum largely red, the legs red except for the mostly black front femora, slightly clouded hind femora, and the usual yellow spots at the base of the tibiae, and invasions of red at the apex of abdominal tergite 1. The rims of the other abdominal tergites brownish

One female collected in Boulder County, Colorado, by Charles H. Hicks, April 5, 1925.

This insect represents a departure from typical *parvum* very similar to that of *Dianthidium ulkei cooleyi* from typical *Dianthidium ulkei*. In both cases there is a tendency to approach the condition of *Dianthidium sayi* in respect to the maculation of the legs and of the tergites of the abdomen. I was at first tempted to believe that the specimen above described might indeed be no other than *Dianthidium ulkei cooleyi*, but the different structure of the mandibles, with the subapical tooth absent, the virtually immaculate clypeus, with merely a specklike trace

of yellow in its lower lateral corners, the reduction of the yellow stripes on the tibiae to basal spots, and the absence of maculations on the front and on the mesopleura—all seem to proclaim affiliation with *parvum* rather than with *ulkei*.

***Dianthidium parvum baculifrons* Cockerell**

This race of *parvum* was described by Professor Cockerell on the basis of a single female from Soboba Springs, Riverside Co., California (1924, Proc. Calif. Acad. of Sciences, XIV, p. 365). Five females and six males collected on June 27, 1931, by Professor H. A. Scullen, some at ten miles east of Santa Fe, New Mexico, at an elevation of 7250 feet, and some at fifteen miles east of Santa Fe, at an elevation of 7100 feet, seem to be assignable to *baculifrons*; and two specimens collected likewise on June 27, 1931, by Mr. Don Prentiss, thirty-five miles east of Santa Fe, at an elevation of 6900 feet, have been similarly designated. The females have light yellow facemarks, including the lower lateral corners of the clypeus, as well as a short yellow bar below the middle ocellus, a continuous semicircular band rimming the axillae and scutellum, a large, pale yellow patch at the base of the third tibiae, and an entirely black sixth tergite—all of these characters being specified in the description of *baculifrons*. The front and middle tibiae of the present specimens have a well-developed stripe, that on the middle tibiae extending to, or almost to, the apex of the joint; and in several specimens the front femora (in one instance also the middle femora) are striped beneath. In typical *parvum* the maculations of the tibiae are confined to the base of the joint and the femora are immaculate.

Only in one or two instances have the associated males even a faint trace of maculation in front of the middle ocellus; the semicircle of yellow rimming their scutellum posteriorly sometimes extends to their axillae, sometimes not; all of them have stripes on the under side of the front femora and one or two of them have such stripes also on the middle femora; the tibial stripes run the full length of the joint, the stripes on the hind tibiae being invaded anteriorly near their middle by an area of black; the sixth tergite is sometimes maculated but not always. On the whole these males seem difficult to separate from the male of typical *parvum*.

Both sexes of *baculifrons*, if these insects be *baculifrons*, are less ornamented than is *parvum swenki*.

***Paranthidium jugatorium* (Say)**

A female from Glenwood Park, Minnesota, collected Aug. 18, is identical in size and closely parallels in its maculations the specimen of *jugatorium* that was recorded from Palisades, New Jersey (1926, Amer. Mus. Novitates, Oct. 9, No. 226, pp. 23-24). Both of these specimens are smaller than those of the subspecies *lepidum*.

***Paranthidium jugatorium* subspecies *lepidum* (Cresson)**

A female from Alexandria, Arlington County, Virginia, collected by C. E. Mickel, Sept. 9, 1928, agrees with what I designated as the allotype of *lepidum* (1926, Amer. Mus. Novitates, Oct. 9, No. 226, pp. 22-23), except that the lateral marks on the clypeus are not united below, and there is no yellow stripe beneath the rather obsolete anterior ocellus.

A female from Lake Toxaway, North Carolina (collection of Mrs. A. T. Slosson), rather closely parallels the maculations of the allotype but is distinctive in having two narrow elongate stripes that run nearly the length of the mesonotum and that are slightly outcurved, diverging from each other continuously almost from their base. The male of *lepidum* on which Cresson's description was based is rather similarly ornamented.

I think these variations are probably individual and not of sub-specific significance, although more extensive material is needed before one can speak with certainty. Broadly considered at least, the subspecies *lepidum* is known from the following states: Georgia, Tennessee, North Carolina, and Virginia.





56.39, 5 L (117:81)

LOVENILAMPAS, A NEW ECHINOIDEAN GENUS FROM THE  
CRETACEOUS OF BRAZIL

BY CARLOTTA JOAQUINA MAURY

A very remarkable echinid was described and figured by the writer in April, 1934, as *Lovenia baixadoleitensis*<sup>1</sup> from the Cretaceous of Baixa do Leite, State of Rio Grande do Norte, Brazil.

The genus *Lovenia*,<sup>2</sup> dedicated to Lovén, was created by Louis Agassiz and Desor, eighty-seven years ago, the genotype being *Lovenia hystrix* A. and D. But, as noted in the original description, my reference of the Brazilian Cretaceous fossil to *Lovenia* was provisional only. It was based upon the presence in the fossil of the very rare characteristic of internal cushions, hitherto known to exist only in the Miocene to Recent genus *Lovenia*, and in the living genus *Homolampas* of Alexander Agassiz.

Dr. Hubert Lyman Clark, of the Museum of Comparative Zoology, Cambridge, and Dr. Robert Tracy Jackson, the greatest authorities on the Echinodermata, find that the character of the peristome of the Brazilian fossil echinid excludes it from the genus *Lovenia*; that it cannot be a *Lovenia* nor any member of that family. Furthermore, Dr. Clark and Dr. Jackson state that there is no genus of Echinoidea, Recent or fossil, which can receive this Brazilian species. Acting therefore upon their kind advice, I am now creating the new genus *Lovenilampas*, with "*Lovenia*" *baixadoleitensis* Maury as the genotype.

I wish to express warmest appreciation of the sympathetic interest and kind and valued judgment of Dr. Clark and Dr. Jackson in the determination of the systematic position of this new genus, which is as follows:

## CLASS ECHINOIDEA BRONN

## ORDER EXOCYCLOIDA JACKSON

In the order Exocycloida, founded by Dr. Jackson,<sup>3</sup> in 1912, the test is irregular, exocyclic, with the periproct outside of the oculo-genital ring, in interambulacrum 5. Two columns of plates lie in each

<sup>1</sup>Maury, Carlotta J. 1934. 'Fossil Invertebrata From Northeastern Brazil,' Bulletin American Museum of Natural History, LXVII, Article IV, p. 156, Pl. xv, fig. 1.

<sup>2</sup>Agassiz and Desor, 1847. 'Annales des Sciences Naturelles,' série 3, VIII, p. 11.

<sup>3</sup>Jackson, Robert Tracy. 1912. 'Key to the Classification of the Echini. Phylogeny of the Echini with a Revision of the Paleozoic Species.' Memoirs Boston Society of Natural History, VII, p. 204.

ambulacral area and two columns of plates in each interambulacral area. Regular in form, or more frequently more or less markedly bilaterally symmetrical through the axis III, 5. Slight or no resorption of



Fig. 1. *Lovenilampas baizadoleitensis*, (Maury, 1934), gen. nov.  $\times 3$ . Showing the phyllodes and the remarkable coating of cushions in the interior of the test. Baixa do Leite, Rio Grande do Norte. Cretaceous. Turonian. A. M. No. 24166.

base of the corona by the advance of the peristome. Lantern present or absent. Peristomal gills, or ambulacral gills only. Sphaeridia present.

This order appeared in the Jurassic and has continued on to the Recent, being represented by living species in our modern seas. Our Brazilian new genus was a Cretaceous member of this order.

Suborder **CASSIDULINA** (Hawkins) Clark

The suborder Cassidulina was proposed by Hawkins, *in litteris*, and was adopted and published by Dr. Clark, in 1925, in his discussion of the echini in the British Museum.<sup>1</sup> In this suborder interambulacrum 5 is not essentially different from the others orally. The ambulacra are more or less petaloid abactinally, with pores similar and normally conjugate.

In this suborder a group of echini are embraced showing intermediate characteristics and lying on the boundary between the clypeastroids and spatangoids. In Dr. Clark's judgment, the characters of the peristome of the Brazilian fossil place it in the suborder Cassidulina.<sup>2</sup>

Family **CASSIDULIDAE** Agassiz

In the family Cassidulidae, proposed by Louis Agassiz, in 1846, the test is variable in shape. Ambulacra and interambulacra disposed to form a floscelle around the mouth by development of phyllodes and bourrelets. Periproct near or above the margin. The well developed phyllodes of our fossil point to membership in this family.

Divergent types represented by *Oligopodia* and *Echinolampas* suggest that interesting lines of interrelationship of living and extinct genera of Cassidulidae may later be traced.

As regards habit of life, members of this family are thought to use their tube feet for locomotion, and to bury themselves only to a slight extent.

The Cassidulidae appeared first in the Jurassic seas and have continued into the modern fauna. But the family is a dying one, for living species are but few.

**LOVENILAMPAS**, gen. nov.

The type and only species yet known of this new genus is *Lovenilampas baixadoleitensis* described and figured as *Lovenia baixadoleitensis* by the writer,<sup>3</sup> April 9, 1934. The specimen was collected by the Inspectoria Federal de Obras Contra as Seccas of Brazil, was sent to the

<sup>1</sup>Clark, Hubert Lyman. 1925. 'A Catalogue of the Recent Sea-Urchins (Echinoidea) in the Collection of the British Museum,' p. 179. London.

<sup>2</sup>Note.—It may here be remarked that the name *Cassidulina* was given by d'Orbigny to a foraminiferal genus, and is valid. But there is nothing in the International Code on Nomenclature that prevents the use for a suborder of a name which may be elsewhere used as a genus.

Furthermore, since the use of the name Cassidulina as a suborder is a relatively new introduction to the group of echini, and to avoid any future confusion regarding terminology, it may be stated that the genus *Cassidulus* was applied a century ago to some fossil sea urchin but was abandoned in the middle of the nineteenth century because it was supposed to conflict with *Cassidula* which had been proposed earlier. Years ago, however, the International Commission decided that *Cassidulus* was not preoccupied by *Cassidula*, and it has accordingly been restored to good and regular standing in the names of sea urchin genera. On the basis of this name Hawkins proposed the suborder Cassidulina which was adopted by Dr. H. L. Clark, in 1925.

<sup>3</sup>Maury, Carlotta J. 1934. 'Fossil Invertebrata From Northeastern Brasil.' Bulletin American Museum of Natural History, LXVII, Article IV, p. 156, Pl. xv, fig. 1.



Department of Geology and Invertebrate Palaeontology of The American Museum of Natural History, New York City, in 1925, and at the request of the Curator, Dr. Chester A. Reeds, was described by the writer. The accession number of the Brazilian collection is 1100, and the catalogue number of *Lovenilampas baixadoleitensis* is 24166, American Museum of Natural History, New York. The figure is herein reproduced.

The type specimen is a fragmentary internal mold, 25 mm. in its greatest dimension, and shows only the character of the interior of the test in the region of the peristome. The phyllodes, or bulb-like expansions of the ambulacra, as they approach the margin of the peristome are very clearly preserved. But the most striking feature is the extraordinary coating of cushions covering the inner surface of the plates of the test. These minute cushions are each about three-quarters of a millimeter in diameter and the center of each is hollowed out so that they resemble miniature air cushions of ring-like form. Apparently these internal cushions formed an intricate pneumatic device connected with the movement of the external spines.

The illustration of the type was drawn with great accuracy and beauty by Mr. George S. Barkentin of New York City.

The name *Lovenilampas* is compounded of *Lovenia* because of the internal cushions similar to those present in that genus, and the termination *lampas*<sup>1</sup> to conform with the termination common in the suborder Cassidulina, as in the related genera, *Echinolampas* and *Conolampas*.

*Lovenilampas baixadoleitensis* inhabited the Cretaceous sea of north-eastern Brazil and is the oldest echinid with internal cushions yet known.

As regards the geographical and geological range of Mesozoic Echinodermata, they are known to be present in nearly all horizons and at widely separated localities, but Clark and Twitchell<sup>2</sup> have stated that they are more numerous and characteristic in Cretaceous than in Triassic and Jurassic formations.

LOCALITY.—The type of *Lovenilampas baixadoleitensis* was collected at Baixa do Leite, southeast of Macau, State of Rio Grande do Norte, Brazil. The matrix is a whitish, siliceous material, partly chalcedonized by infiltration and replacement by aqueous solutions. The location is near the contact of the Cenozoic coastal belt with the Cretaceous limestone belt of Rio Grande do Norte.

<sup>1</sup>The true signification is from the Greek, a torch or lamp, but there is no certainty at all that Aristotle's Lantern was present in these cassiduloids.

<sup>2</sup>Clark, W. B., and Twitchell, M. W. 1915. 'Mesozoic and Cenozoic Echinodermata of the United States.' Monographs United States Geological Survey, LIV, p. 9.

HORIZON.—The associated molluscan genus *Nerinea* proves that the Baixa do Leite formation goes with the Cretaceous belt of the State. Moreover, the presence in the same chalcedonized matrix of *Nerinea* (*Pygmatis*) *baixadoleitensis* Maury, which shows affinities with both *Nerinea* (*Pygmatis*) *requieniana* d'Orbigny and with *N. (Pygmatis) carentonensis* Cossmann, both from the Turonian of Châteauneuf, points to the Turonian stage. The aggregate palaeontological evidence of all fossils from the Cretaceous belt of Rio Grande do Norte is harmonious with this indication.

The age of *Lovenilampas baixadoleitensis* is thus proven to be Cretaceous, and it is tentatively referred to the Turonian stage of that period.



59.57, 89 H (85)

NEW HESPERIIDAE FROM TRINIDAD AND PERU  
(LEPIDOPTERA: RHOPALOCERA)

By E. L. BELL

Descriptions of five new species of American HesperIIDae are presented in the following pages, together with illustrations of parts of the male genitalia. Types of all the species are deposited in The American Museum of Natural History, while paratypes, where available, are in other collections.

*Celaenorrhinus bifurcus*, new species

Figure 3

This species so closely approximates *eligius* Cramer in size and maculation that it is doubtful if the two can always be accurately separated on their superficial characters. In specimens at hand the principal differences between them appear to be in the fringes of the hind wings of *bifurcus* being feebly checkered; the rather prominent white spot in interspace 1 toward the base, usually found in *eligius*, being either very minute or entirely absent and replaced by a black dot in *bifurcus*; and in the two small but distinct white dots in interspaces 4 and 5 just below the subapical series of *eligius* being either very minute or absent in *bifurcus*. Both sexes are similar in appearance.

The form of the male genitalia of *bifurcus* materially differs in the claspers from that of *eligius*. In *eligius* the terminal arm of the clasper is normally comparatively short, rather broad, the ventral edge and apex evenly rounded, with a small, sharp hooklike point at the junction with the dorsal edge. In *bifurcus* the terminal arm is longer and narrower, somewhat bulged at the base, from where it is bent obliquely upward and tapers narrowly just before the apex which is split into two prominent thornlike processes, the lower one directed outwardly and the upper one obliquely upward.

EXPANSE.—Male, 44 mm.; female, 46 mm.

TYPES.—Holotype male, Mt. Tucuche; allotype female, Lady Chancellor's Road, St. Ann's (Pinkus). Paratypes: one male, Santa Cruz Valley (Huntington); one male, locality unknown; one male, Fondes Amandes Road (Pinkus). The holotype and allotype are in the collection of The American Museum of Natural History; one paratype is in the collection of the Academy of Natural Sciences, Philadelphia, Pa.; and the other two paratypes are in the collection of the author.

All of the localities mentioned are in Trinidad, British West Indies.

*Pythonides eminus*, new species

Figure 1

MALE.—Upper side: primaries violaceous, a dark brown outer marginal band widening from the apex to the inner margin, where it is very broad; a band of black

spots beginning between veins 9 and 10 and extending around the end of the cell; a black band beginning narrowly near the center of the costal margin and extending through the cell to the inner margin, where it is very much broader. Secondaries dark brown except the basal third, which is violaceous, crossed by a narrow brown stripe and with a brown spot above vein 7 near the base. Fringes concolorous.

Beneath: primaries violaceous brown, paler in the lower half, an indistinct, narrow, brown submarginal band and another extending from the costal margin around the end of the cell to the inner margin. Secondaries a little paler than the primaries, with two indistinct, narrow, darker bands, one submarginal and the other discal.

Thorax and abdomen above blackish, beneath dark brown. Head above, collar, shoulder-covers, and tegulae brown. Palpi beneath dark brown with a few paler brown hairs intermixed. Legs brown, with one pair of spurs and no tuft on the hind tibiae. Antennae black above, brownish beneath.

EXPANSE.—34 mm.

HOLOTYPE.—Male, Yumbatos, Peru (Klug), in collection of The American Museum of Natural History.

This species looks somewhat like a small individual of *Pellicia costimacula* Herrich-Schaffer, on the upper side, the secondaries are not so produced anally as in that species, and there is no hair tuft from the basal costal area of those wings. *Eminus* differs from the other *Pythonides* (*Ate* Godman and Salvin) species in having no tibial tuft in the male. There does not seem to be any previously described species in this genus with which *eminus* may be confused on the superficial characters.

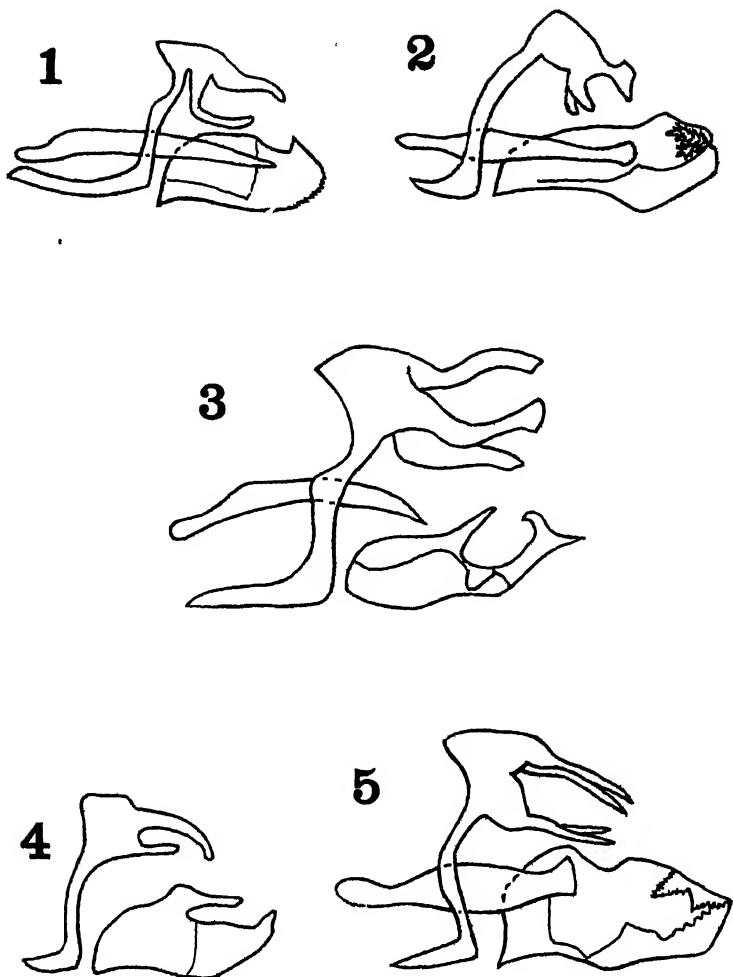
The uncus is a single arm slightly depressed toward the apex. There is a well-developed scaphium; the saccus and oedagus are long; the claspers are rounded at the apex, with a short dorsal tooth and some serrations on the outer part of the ventral edge.

### *Pythonides juxta*, new species

#### Figure 4

MALE.—Upper side: primaries pale brown, a marginal blackish band, a large, irregularly squarish, velvety black spot through the cell to the inner margin, basal half of the costal margin black, a triangular black spot bordering the end of the cell; on the outer edge of this spot there are two white hyaline subapical spots in cells 6 and 8. Secondaries velvety black with an indistinct, paler outer marginal band. Beneath dark brown, the primaries darker in the basal half, an indistinct, narrow, darker outer marginal band, the triangular spot bordering the cell end less distinct than above, the two subapical spots repeated. Secondaries with a narrow, indistinct antemarginal darker band, a broader, indistinct dark spot through the cell enclosing a small paler streak. Fringes concolorous.

Head and body dark brown above and beneath, a few paler brown hairs on the abdomen beneath. Palpi brown beneath with ochreous hairs intermixed. An orange spot beneath the eyes. Pectus same color as palpi. Legs brown, one pair of spurs and a long dorsal hair tuft on the hind tibiae. Antennae black above, paler brownish beneath.



#### MALE GENITALIA

- Fig. 1. *Pythonides eminus*, new species. Peru. Type.  
 Fig. 2. *Potanihus maracanae*, new species. Trinidad. Paratype.  
 Fig. 3. *Celaenorrhinus bifurcus*, new species. Trinidad. Paratype.  
 Fig. 4. *Pythonides juxta*, new species. Peru. Type.  
 Fig. 5. *Rhinthon proximus*, new species. Trinidad. Paratype.

FEMALE.—Same as the male, but the pale areas on both sides are more pronounced, thus making the dark bands more prominent, especially beneath.

EXPANSE.—Male, 36 mm.; female, 32 mm.

TYPES.—Holotype male and allotype female, San Antonio, Peru (Klug), in collection of The American Museum of Natural History.

This species is superficially very much like *Quadrus noctis* Lindsey, but differs in the form of the dark maculation and has the two subapical spots on the primaries which are lacking in *noctis*. It also has but one pair of spurs on the hind tibiae whereas *noctis* has two pairs. The form of the male genitalia also differs in the two species. In the genus *Pythonides*, *juxta* is somewhat like the previously described *eminus*, differing from it in the form of the dark maculation, the presence of the two subapical spots, and the hair tuft on the hind tibiae. This species does not exactly agree with characters given for the genus in that the hair tuft of the hind tibiae is dorsal and does not proceed from the inner side.

The uncus is a single, strongly developed arm, slightly curved downward. The saccus and oedagus are short. The claspers terminate in a tapering, slightly upcurved arm pointed at the apex, with another dorsal arm from near the base, projecting obliquely upward and then forward.

#### **Potanthus maracanae**, new species

##### Figure 2

MALE.—Upper side: primaries black; a bright fulvous discal band, divided into spots by the veins, extends tapering from the basal half of the inner margin to just under the cell-end in interspace 4, from where it is continued around the end of the cell as a series of small elongate spots, one in each interspace from 5 to 10 and as a costal marginal stripe to the base of the wing, where it broadens and extends a little into the base of the cell. The spot of the discal band in interspace 1 does not reach the lower edge of the cell, thus leaving a narrow black area between it and the lower margin of the cell. In occasional individuals there may be also one or two minute fulvous spots in the cell near the apex. Fringes paler brownish, sometimes becoming fulvous toward the anal angle. Secondaries black, with a discal band of four elongate, bright fulvous spots forming an oblique patch; lower part of the cell and area between the discal band and inner margin of the abdominal fold, as well as the inner margin of the fold itself, covered with long fulvous hairs. Fringes fulvous, becoming brighter toward the anal angle.

Beneath: primaries. The area occupied on the upper side of the wings by the fulvous spots from the upper part of that in interspace 1 to the costal margin and along it to the base of the wing is here paler yellowish than the rest; the apex and outer marginal band, which becomes very narrow below vein 2, are fulvous brown; the basal area and lower half of the cell, the base of the wing, a large spot toward the outer margin in interspace 2, all of the interspace 1 (excepting sometimes a small yellow area near the center of vein 2), and all of the area below vein 1 are black. The

apex of the cell is crossed by a narrow black bar. Secondaries yellowish, the area occupied by the fulvous discal patch on the upper side is faintly paler than the rest of the wing. Along the outer margin of the wing the veins are a little paler, producing the appearance of a marginal band of slightly darker, elongate spots, which are longest toward the anal angle: an ill-defined stripe of black scales lies along the inner margin of the abdominal fold.

Head, palpi, collar, tegulae, thorax and abdomen fulvous brown, with a slight greenish tinge. Palpi beneath brighter fulvous, sometimes with a greenish tinge, some scattered black scales intermixed. Pectus and thorax bright fulvous, sometimes with a slight greenish tinge. Abdomen whitish with a narrow, central brown line. Legs fulvous. Antennae above black with a yellow band at the base of the club, beneath fulvous, spotted with black at the joints, the basal half of the club and just below the base of it entirely fulvous, the apiculus fulvous.

FEMALE.—Dark brown above, a little paler beneath. The fulvous hairs of the body, head, palpi, and pectus are darker than in the male. The abdomen beneath has a much broader central brown stripe than that of the male.

EXPANSE.—Male, 30–34 mm.; female, 30–34 mm.

TYPES.—Holotype male and allotype female, Maracas Bay, in collection of The American Museum of Natural History. Paratypes: one male and five females, Maracas Bay; one male, Brasso; one male, Botanical Gardens, Port-of-Spain; one female, Fondes Amandes Road, in collection of the author; one male, two females, Maracas Bay; one male, one female, Botanical Gardens, Port-of-Spain; one male, Brasso; one female, Cascade Mountain Road, in collection of Mr. A. S. Pinkus; one male, Brasso; one female, Palo Seco-Erin, in collection of the U. S. National Museum, Washington, D. C.; one male, Brasso; one female, Palo Seco-Erin, in collection of the Academy of Natural Sciences, Philadelphia, Pa.; one male, one female, Maracas Bay, in collection of the British Museum of Natural History.

All of the localities mentioned are in Trinidad, British West Indies, and all specimens were collected by Mr. A. S. Pinkus.

This insect is a close ally of *epictetus* Fabricius, but it is slightly larger in size and usually lacks the small but conspicuous fulvous spot found in the lower part of the cell of the primaries of *epictetus*. When present, this spot is very minute and not conspicuous in *maracanae*. *Maracanae* still more closely resembles the insect identified by Dr. Lindsey as *eudesmia* Plotz, on the upper side usually differing from it in the less extended fulvous areas (this difference may be obliterated by the variation in individuals) and the brighter tone of the fulvous areas. In *eudesmia* the subapical spots are limited to two, which are much more elongate than those in the band of spots in *maracanae*, and are never connected with the discal band as they are in *maracanae*. Beneath, the palpi of *eudesmia* are more yellowish and lack the greenish tinge. The form of the male genitalia of *maracanae* materially differs from that of *epictetus* and *eudesmia*.



It may be possible that this insect has been previously described under some other name, but it has been impossible to identify it from any of the published descriptions.

***Rhinthon proximus*, new species**

Figure 5

MALE.—Upper side: both wings brown, immaculate. Fringes a little paler. Primaries with a narrow, indistinct stigma below vein 1 toward the base.

Beneath: a little paler than above. Primaries in the apical, outer, and inner marginal areas paler than the rest of the wing. There is a purplish suffusion on both wings, which is more prominent on the secondaries.

Body brown. Tegulae, shoulder-covers, collar, head, and palpi above brown with yellowish hairs intermixed. Beneath, the palpi and pectus are yellowish intermixed with brown. Thorax beneath yellowish gray. Abdomen beneath sordid whitish with a central brown stripe. Legs brown, paler interiorly.

FEMALE.—Similar to the male; wings more rounded, without the stigma.

EXPANSE.—Male, 38–40 mm.; female, 42 mm.

TYPES.—Holotype male and allotype female, Putumayo River region, Peru (Klug), in collection of The American Museum of Natural History. Paratypes: one male, Tabaquite, Trinidad, British West Indies (Pinkus), in collection of the author; one male, Tabaquite, in collection of Mr. A. S. Pinkus; one male, Palo Seco-Erin, Trinidad, British West Indies (Pinkus), in collection of the British Museum, London, England.

The male stigma differs from that of typical *Rhinthon* in that it lies along the lower side of vein 1 instead of along the upper side of that vein. Superficially *proximus* resembles *megalops* Godman, but it differs from that species in the form and position of the stigma of the male. The form of the male genitalia is also quite distinct from that of *megalops*.





56.4 (117:78.6)

A MOLLUSCAN FAUNULE FROM THE PIERRE FORMATION  
IN EASTERN MONTANABY H. N. CORYELL<sup>1</sup> AND ELEANOR S. SALMON<sup>1</sup>

The fossils listed and described in this report were collected in the fall of 1930 and presented to the Geology Department of Columbia University for study, by Mr. Theron Wasson, Chief Geologist of the Pure Oil Company. They were obtained from a horizon about 100 feet below the top of the Pierre, at a point near the northwest end of the



Fig. 1. Map of Montana, showing region from which fossils were collected (X).

Cedar Creek anticline, and near the center of that section of the anticline known as the Gas City Dome, south of Glendive, Montana (Fig. 1). This locality lies a little west of the center of Township 14 North, Range 55 East, in Dawson County, Montana (Fig. 2).

The report includes a general summary of the stratigraphy of the Pierre formation as a whole, with a more detailed lithologic description of the member in which the fossils occur, and especially of the concretions in which they are found. A study was made to determine whether

<sup>1</sup>Department of Geology, Columbia University.

the exceptionally good state of preservation of the fossil shell material is due to the presence of bituminous matter, or to some other cause, or both. The report also includes a list of the fossils of this faunule, which consists entirely of Mollusca, together with a description and classification of some new species. Thirty-five species in all are represented; of these, eight are Gastropoda, ten are Cephalopoda, fifteen are Pelecypoda, and two are Scaphopoda. The two new species described are ammonoid

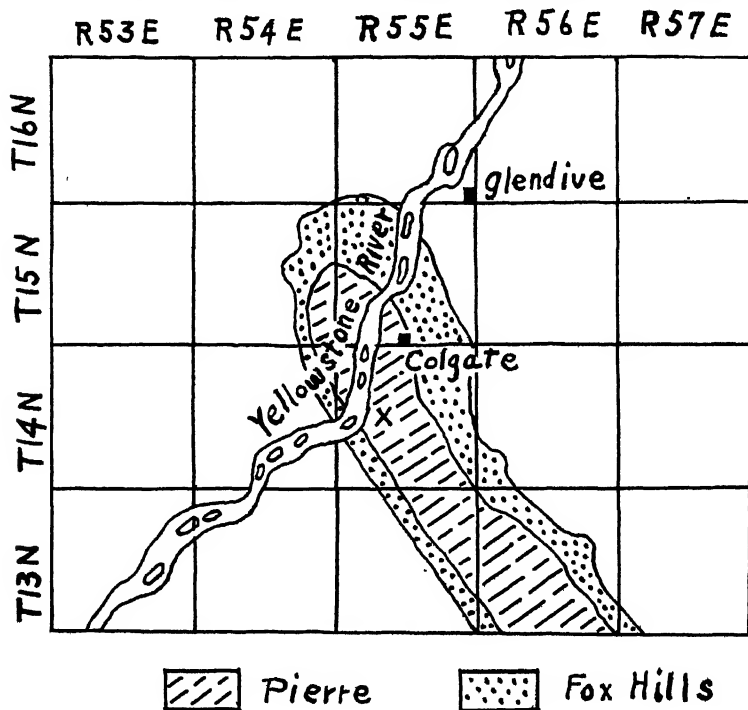


Fig. 2. Map of a part of Cedar Creek Anticline, showing locality (X) from which fossils were collected.

Cephalopoda. There is also a discussion of the classification and nomenclature of one of Meek's species of Cephalopoda. Photographs of all species described in this paper are presented in figures 5-13.

#### STRATIGRAPHY

The Pierre shale is one of the thickest and most widespread of the Upper Cretaceous formations of the western United States. It forms the greater part of the Montana Group, of Gulfian age (Fig. 3). Its thick-

ness ranges from about 700 feet in the Black Hills of South Dakota, to 1100 feet in southern North Dakota, and to a minimum of 1750 feet in northeastern Wyoming and southeastern Montana. It covers many square miles of territory, outcropping widely in South Dakota, where it encircles the Black Hills in a wide band. It is the surface formation in most of the eastern part of North Dakota, and appears frequently in the southern and southwestern sections. The Pierre is also to be found outcropping extensively in eastern Wyoming and southeastern Montana. In the southwest corner of North Dakota, it comes to the surface and is exposed in a wide band all along the axis of the Cedar Creek anticline,

Series	Group	Formation and Member		Thickness
Cretaceous or  Gulfian	Montanan	Fox Hills Sandstone		150'-250'
		Pierre shale	Dark grey shale with concretions	150'-250'
			Monument Hill bentonitic member	150'
			Dark mudstone and shale with abundant concretions	500'-800'
			Mitten black shale member	150'-200'
			Gammon ferruginous member Groat ss. bed Pedro bentonite bed	800'-1000'
	Coloradan	Niobrara formation		375'-625'
Carlile shale		225'-325'		
Greenhorn formation		50'-350'		
Graneros shale		650'-1575'		

Fig. 3. Stratigraphic chart of Upper Cretaceous formations of southeastern Montana. After Rubey, modified.

which extends to the northwest about 70 miles into Montana, ending a few miles west of the Yellowstone River (Fig. 2).

The Pierre has been subdivided into five members<sup>1</sup> (Fig. 3). The lowest of these is the Gammon ferruginous member, consisting of 800-1000 feet of light gray mudstone and shale with abundant iron-stained concretions and thin beds of siderite. The fossils, which are scarce, are marine. The member contains, near the top, the Groat Sandstone bed, of ferruginous and glauconitic sandstone and siltstone, with a thickness up to 150 feet; it also contains, near the base, the Pedro bentonite bed, of hard, white, massive clay and tuff, locally 20 feet thick but not widespread. Above the Gammon lies the Mitten black shale member, con-

<sup>1</sup>Rubey, W. W. 1930. U. S. G. S. Prof. Paper 165, pp. 3-5.

sisting of 150 to 200 feet of blue-black, fissile shale with a few iron-stained calcareous concretions, and containing marine fossils. This member is overlain by 500 to 800 feet of dark mudstone and shale with abundant calcareous concretions and marine fossils. The rock is light gray in the upper part and iron-stained in the lower. Above it lies the Monument Hill bentonitic member, consisting of about 150 feet of impure bentonite and siltstone, with some calcareous and barite con-

Pierre	Pierre and Fox Hills	Fox Hills
<i>Inoceramus proximus</i>	<i>Nucula cancellata</i>	<i>Protocardia subquadrata</i>
<i>Dentalium gracile</i>	<i>Nucula subplana</i>	<i>Corbula crassimarginata</i>
<i>Alaria sublevis</i>	<i>Limopsis parvula</i>	<i>Discoascaphites nicolleti</i>
<i>Alaria nebrascensis</i>	<i>Inoceramus barabini</i>	
<i>Fasciolaria cheyennensis</i>	<i>Pteria nebrascana</i>	
<i>Eutrophoceras dekayi</i>	<i>Pteria petrosa</i>	
<i>Baculites compressus</i>	<i>Cuspidaria ventricosa</i>	
<i>Baculites ovatus</i>	<i>Cuspidaria moreauensis</i>	
<i>Acanthoscaphites nodosus</i>	<i>Lucina occidentalis</i>	
<i>A. nodosus brevis</i>	<i>Lucina subundata</i>	
<i>A. nodosus compressus</i>	<i>Protocardia rara</i>	
<i>A. nodosus plenus</i>	<i>Dosiniopsis deweyi</i>	
	<i>Dentalium pauperculum</i>	
	<i>Margarita nebrascensis</i>	
	<i>Natica concinna</i>	
	<i>Pyrifusus newberryi</i>	
	<i>Pyrifusus intertextus</i>	
	<i>Turris minor</i>	

Fig. 4. Table of horizons at which species of this faunule have previously been found.

cretions, and marine fossils. The top member of the formation, from which the fossils herein described were collected, consists of 150 to 200 feet of dark gray, fissile shale and mudstone, containing locally light buff sandy shales. Crystals of selenite are plentiful throughout the beds, and very fine-grained, calcareous concretions are also quite abundant, especially near the top.<sup>1</sup>

<sup>1</sup>Calvert, W. R. 1907. U. S. G. S. Bull. 471, pp.192-193.

Rubey,<sup>1</sup> who has made an extensive study of this and other fine-grained Upper Cretaceous formations in the Black Hills region, includes an analysis of the beds just below the Monument Hill member. He finds that the chief constituent of these beds is definitely crystalline micaceous clay, probably of the beidellite type. They also contain some fine quartz sand or silt. They are moderately calcareous, containing 6.78% of calcium carbonate, and also include 1.48% of pyrite, disseminated throughout. Organic matter in general was found to amount to 2.39%, of which 0.10% was in the form of chloroform-soluble bitumens. The beds analyzed are apparently quite similar lithologically to those under consideration here, which occur at the top of the formation.

#### PALAEONTOLOGY

In the locality under discussion, many fossils are found in the lime concretions, although the surrounding shales are unfossiliferous.<sup>2</sup> The fossils listed and described in this report are all Mollusca, and are in an excellent state of preservation. The exteriors of many of the shells, especially of the cephalopods, still retain the original pearly luster, and very few show any signs of deformation. Thin sections of the concretions cut through embedded fossils show that the interiors of the fossils are filled with quite pure crystalline calcite; the shells themselves consist of two layers, a thin inner one of platy or amorphous calcite, and an outer one of fibrous aragonite, in a practically unaltered state. Surrounding the shells is the matrix of interlocking fine-grained calcite and clay particles, with abundant flecks of pyrite.

It has been suggested that the excellent preservation of the fossils in these concretions may be due to the presence of oil or bituminous matter of some sort, which would tend to keep the groundwater out and thus prevent solution or alteration of the pearly shell material.<sup>3</sup> That organic matter is present in the concretions is indicated by the pyrite, since this mineral very often occurs in association with such material, and also by the dark color, which is not caused by dark detrital minerals, since none are present in the thin sections. Tests of the material of the concretions, pulverized and treated with ether, showed a very small amount of soluble bituminous matter. The extremely fine-grained character of the concretions, which show only a very slight porosity in thin section, would also tend to prevent any circulation of groundwater within the rock. Moreover, Tarr<sup>4</sup> has shown that these concretions are

<sup>1</sup>Rubey, *op. cit.*, pp. 5-11.

<sup>2</sup>Communication from Mr. Theron Wasson.

<sup>3</sup>Communication from Mr. Theron Wasson.

<sup>4</sup>Tarr, W. A. 1920. G. S. A. Bull. 32, pp. 373-384.



syngenetic, that is, formed at the time of the deposition of the enclosing rock. This would mean that the fossils within the concretions were buried almost immediately after death.

In view of these facts, then, it may be concluded that the preservation of the pearly shell material of these fossils is due to the fact that they have been protected, since the deposition of the formation, by an enveloping medium of an extremely dense and non-porous character, which was also impregnated with bituminous matter.

The fossils from this horizon do not constitute a restricted Pierre fauna. The majority are species which have previously been found both in this formation and in the Fox Hills sandstone which overlies it. The next largest group comprises those which have been found hitherto only in the Pierre, and the remainder, a very small group, are those which have not been found before except in the Fox Hills (see Fig. 4). We believe this horizon must be correlated with that referred to frequently by Meek<sup>1</sup> as "a bed containing a blending of the fossils from the upper part of the Fort Pierre and Fox Hills groups . . .," especially since his locality, "Yellowstone River, 150 miles from its mouth," lies only about 50 miles south of the locality of the fossils under discussion. It is not unnatural that the upper beds of the Pierre in this region should contain fossils in common with the overlying formation, since here there is no distinct stratigraphic break between the two, but a gradation from the lower into the higher.<sup>2</sup>

#### SYSTEMATIC PALAEONTOLOGY

The following is a list of the species represented in this faunule. A few references are given for each species, although the reference lists are not, in most cases, complete. The original reference is included for each species; in cases where this is a publication which is difficult to obtain, or where an illustration is not included, further references are also given. Comments upon our specimens are added wherever necessary, and some changes in classification have been made, after other authors.

#### PELECYPODA

##### *Nucula cancellata* Meek and Hayden, 1856

*Nucula cancellata* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 85.

*Nucula cancellata* MEEK, F. B., 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 102, Pl. XXVIII, fig. 13, a-c.

<sup>1</sup>Meek, F. B. 1876. 'Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country,' U. S. G. and G. S. Terr. (Hayden), IX, p. 100.

<sup>2</sup>Rubey, op. cit., Chart, p. 8.

One specimen of this species is included in this faunule. Its size is considerably smaller than the measurements given by Meek, but agrees with the figure, natural size, of the type specimen, as illustrated by Meek, Plate xxviii, figure 13a. Although nearly all the outer layers of the shell are missing from our specimen, in the few patches left it is possible to see the cancellate sculpture faintly, while the crenulations along the basal margin are quite distinct.

***Nucula* cf. *subplana* Meek and Hayden, 1856**

*Nucula subplana* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 85.

*Nucula subplana* MEEK, F. B., 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 99, Pl. xvii, fig. 7, a-b.

Our specimen agrees with Meek's description and figures in size, shape, and absence of crenulations on the basal border, but some of the shell material is preserved, showing strong concentric striae and very fine radial markings, the latter being also shown on the internal mold. This ornamentation was apparently not shown on Meek's specimens. This fact, and the fact that our specimen is proportionally somewhat more convex than Meek's type, make us hesitate to identify it with his without reservations. It may be, however, that Meek's specimens did not show the radial markings on the internal mold because of poor preservation, since they are shown on ours only near the ventral border, and disappear completely near the umbo.

***Limopsis parvula* (Meek and Hayden), 1856**

*Petunculina parvula* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 86.

*Limopsis parvula* MEEK, F. B., 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 97, Pl. xxviii, fig. 17, a-c.

This species occurred very abundantly in our collection.

***Inoceramus proximus* Tuomey, 1854**

*Inoceramus proximus* TUOMEY, 1854, Proc. Acad. Nat. Sci. Phila., VIII, p. 171.

*Inoceramus proximus* WELLER, 1907, Pal. N. J., IV, p. 424; Pl. xl, figs. 1-6; Pl. xli, fig. 1.

***Inoceramus barabini* Morton, 1834**

*Inoceramus barabini* MORTON, 1834, Synop. Organic Rem., p. 62, Pl. xvii, fig. 3.

*Inoceramus barabini* WHITFIELD, 1880, 'Paleontology of the Black Hills of Dakota,' p. 398, Pl. vii, fig. 7; Pl. ix, fig. 8.

Of the three specimens in this collection, two agree very well with the description given by Meek, but the third is somewhat more difficult of

identification. It is a small specimen, measuring  $1\frac{1}{2}$  inches in length; the convexity,  $\frac{1}{2}$  inch in the right valve alone, seems proportionally large for this species, and the ventral margin seems to be more or less parallel with the hinge line, so that this specimen has not the typical cuneate form of *Inoceramus barabini* Morton. It somewhat resembles *Inoceramus confertim-annulatus* Roemer, as described and figured by Weller (Pal. N. J., IV, p. 427, Pl. xxxix, figs. 2-5). However, we hesitate to identify it with this form, since ours is apparently a young specimen, and might have become proportionally less convex and more cuneate as it grew longer and higher.

***Pteria petrosa* (Conrad), 1853**

*Avicula petrosa* CONRAD, 1853, Jour. Acad. Nat. Sci. Phila., 2nd Ser., II, p. 274, Pl. xxiv, fig. 15.

*Pteria linguiformis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 32, Pl. xvi, fig. 1, a-d.

The specimen in our collection is very poor, consisting of only the right valve, of which the anterior wing and part of the anterior margin have been broken off. However, from the absence of any radial markings, and the general form of the posterior wing and basal portion of this valve, we feel fairly safe in assigning it to this species.

***Pteria (Oxytoma) nebrascana* (Evans and Shumard), 1857**

*Avicula nebrascana* EVANS AND SHUMARD, 1857, Trans. Acad. Sci. St. Louis, I, p. 38.

*Pteria (Oxytoma) nebrascana* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 34, Pl. xvi, fig. 3, a-c; Pl. xxviii, fig. 11.

***Cuspidaria ventricosa* (Meek and Hayden), 1856**

*Corbula ventricosa* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 83.

*Neaera ventricosa* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 238, Pl. xxx, fig. 3, a-e.

***Cuspidaria moreauensis* (Meek and Hayden), 1856**

*Corbula moreauensis* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 83.

*Neaera moreauensis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 239, Pl. xvii, fig. 11, a-c.

***Lucina occidentalis* (Morton), 1842**

*Tellina occidentalis* MORTON, 1842, Jour. Acad. Nat. Sci. Phila., VIII, p. 210, Pl. xi, fig. 3.

*Lucina occidentalis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 134, Pl. xvii, fig. 4, a-d.

Specimens of this species were very numerous in our collection.

**Lucina subundata** Hall and Meek, 1854

*Lucina subundata* HALL AND MEEK, 1854, Mem. Am. Acad. Arts and Sci. Boston, V, new series, Pl. 1, fig. 6.

*Lucina subundata* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 133, Pl. xvii, fig. 2, *a-e*.

**Protocardia subquadrata** (Evans and Shumard), 1857

*Cardium subquadratum* EVANS AND SHUMARD, 1857, Trans. Acad. Sci. St. Louis, I, p. 39.

*Protocardia (Leptocardia) subquadrata* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 175, Pl. xxix, fig. 8, *a-e*.

**Protocardia rara** (Evans and Shumard), 1857

*Cardium rarum* EVANS AND SHUMARD, 1857, Trans. Acad. Sci. St. Louis, I, p. 39.

*Protocardia (Leptocardia) rara* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 176, Pl. xvii, fig. 1, *a-c*.

**Dosiniopsis deweyi** (Meek and Hayden), 1856

*Cytherea deweyi* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 83.

*Callista (Dosiniopsis ?) deweyi* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 182, Pl. xvii, fig. 15, *a-e*.

**Corbula crassimarginata** Meek and Hayden, 1860

*Corbula crassimarginata* MEEK AND HAYDEN, 1860, Proc. Acad. Nat. Sci. Phila., VIII, p. 425.

*Corbula crassimarginata* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 244, Pl. xvii, fig. 14, *a-c*.

**SCAPHOPODA****Dentalium (Antalis) gracile** (Hall and Meek), 1854

*Dentalium gracile* HALL AND MEEK, 1854, Mem. Am. Acad. Arts and Sci., V, New Ser., p. 303, Pl. iii, fig. 11.

*Dentalium gracile* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 266, Pl. xviii, fig. 13, *a-d*.

**Dentalium (Laevidentalium) pauperculum** (Meek and Hayden), 1860

*Dentalium pauperculum* MEEK AND HAYDEN, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 178.

*Antalis ? paupercula* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 269, Pl. xviii, fig. 14.

**GASTROPODA****Margarita nebrascensis** (Meek and Hayden), 1856

*Turbo Nebrascensis* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 64.

*Margarita nebrascensis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 298, Pl. xix, fig. 8, *a-b*; fig. 9, *a-b*.

**Natica (Lunatia) concinna** (Hall and Meek), 1854

*Natica concinna* HALL AND MEEK, 1854, Mem. Am. Acad. Arts and Sci. Boston, V, p. 384, Pl. III, fig. 2, a-d.

*Lunatia concinna* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 314, Pl. XXXII, fig. 11, a-c.

**Alaria (Anchura) sublevis** (Meek and Hayden), 1860

*Aporrhais sublevis* MEEK AND HAYDEN, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 178.

*Anchura ? sublevis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 327, Pl. XIX, fig. 3, a-b.

**Alaria (Anchura) nebrascensis ?** (Evans and Shumard), 1854

*Rostellaria Nebrascensis* EVANS AND SHUMARD, 1854, Proc. Acad. Nat. Sci. Phila., VI, p. 164.

*Anchura (Drepanochilus) Nebrascensis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 326, Pl. XIX, fig. 5, a-c.

Our specimen consists only of an internal mold, with a small remnant of shell left on the outer lip, showing the revolving striae. We cannot tell, therefore, what the surface markings of the rest of the shell may be, but the specimen agrees so well in size, form of the outer lip, and position of the carinae on the body whorl with both Meek's and Whitfield's descriptions, that we feel reasonably sure it belongs to the same species.

**Pyrifusus (Neptunella) newberryi** (Meek and Hayden), 1856

*Fusus Newberryi* MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 66.

*Pyrifusus (Neptunella) newberryi* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 346, Pl. XXXI, fig. 6, a-f.

**Pyrifusus (Neptunella) intertextus** (Meek and Hayden), 1857

*Fusus intertextus* MEEK AND HAYDEN, 1857, Proc. Acad. Nat. Sci. Phila., IX, p. 139.

*Pyrifusus (Neptunella) intertextus* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 348, Pl. XIX, fig. 14, a-b.

**Fasciolaria (Cryptorhytis) cheyennensis** (Meek and Hayden), 1860

*Rostellaria fusiformis* HALL AND MEEK, 1854, Mem. Am. Acad. Arts and Sci. Boston, V, New Ser., p. 393, Pl. III, fig. 10. (Not *R. fusiformis* Pictet and Roux, 1848, nor *Fasciolaria fusiformis* Valenciennes.)

*Gladius ? cheyennensis* MEEK AND HAYDEN, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 422.

*Fasciolaria ? (Cryptorhytis) cheyennensis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 365, Pl. XIX, fig. 13, a-b.

**Turris (Surcula) minor** (Evans and Shumard), 1857

*Pleurotoma minor* EVANS AND SHUMARD, 1857, Trans. Acad. Sci. St. Louis, I, p. 41.

*Turris minor* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 384, Pl. XXXI, fig. 9, a-c.

**CEPHALOPODA****Eutrephoceras dekayi** (Morton), 1833

*Nautilus dekayi* MORTON, 1833, Am. Jour. Sci., 1st Ser., XXIII, p. 291, Pl. VIII, fig. 4.

*Nautilus dekayi* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 496, Pl. XXVII, fig. 1, a-e.

**Baculites compressus** Say, 1821

*Baculites compressus* SAY, 1821, Am. Jour. Sci. and Arts, II, p. 41.

*Baculites compressus* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 400, Pl. XX, fig. 3, a-c.

**Baculites ovatus** Say, 1821

*Baculites ovata* SAY, 1821, Am. Jour. Sci. and Arts, 1st Ser., II, p. 41.

*Baculites ovatus* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 394, Pl. XX, fig. 1, a-b; fig. 2, a, b, d.

**Discoscaphites nicolleti** (Morton), 1842

*Ammonites Nicolletii* MORTON, 1842, Jour. Acad. Nat. Sci. Phila., 1st Ser., VIII, pt. 2, p. 209, Pl. x, fig. 3.

*Scaphites (Discoscaphites) nicolleti* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 435, Pl. XXXIV, figs. 2, a-b; 4, a-c.

*Discoscaphites nicolleti* REESIDE, 1927, U. S. G. S. Prof. Paper 150, p. 32, Pl. IX, figs. 5, 7.

**Acanthoscaphites nodosus** (Owen), 1852

*Scaphites (Ammonites ?) nodosus* OWEN, 1852, Rept. of Geol. Surv. Wisc., Iowa and Minn., p. 581, Tab. 8, fig. 4.

*Scaphites nodosus* WHITFIELD, 1880, Pal. of B. H. of Dak., p. 441, Pl. XIII, fig. 12.

*Acanthoscaphites nodosus* REESIDE, 1927, U. S. G. S. Prof. Paper 150, p. 32.

**Acanthoscaphites nodosus brevis** (Meek), 1876

*Scaphites nodosus brevis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 426, Pl. XXV, fig. 1, a-c.

**Acanthoscaphites nodosus plenus** (Meek and Hayden), 1860

*Scaphites nodosus plenus* MEEK AND HAYDEN, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 420.

*Scaphites nodosus plenus* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 429, Pl. XXVI, fig. 1, a-c.

DISCUSSION OF A PROBLEM OF NOMENCLATURE  
AND DESCRIPTIONS OF NEW SPECIES

## CEPHALOPODA

**Acanthoscaphites nodosus comprimus** (Owen), 1852

Figures 5, 6

A. M. N. H. Cat. No. 24236.

*Scaphites* (*Ammonites* ?) *comprimus* OWEN, 1852, Rept. of Geol. Surv. Wisc., Iowa and Minn., p. 580, Tab. 7, fig. 4.*Scaphites nodosus quadrangularis* MEEK AND HAYDEN, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 420.*Scaphites nodosus exiles* MEEK AND HAYDEN, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 420.*Scaphites nodosus quadrangularis* GABB, 1861, Syn. Moll. Cret. Form., p. 32.*Scaphites nodosus quadrangularis* MEEK, 1876, Invert. Cret. and Tert. Foss., Up. Mo., p. 428, Pl. XXV, figs. 2, a-c; 3, a-c; 4.*Scaphites nodosus quadrangularis* WHITFIELD, 1880, Pal. of B. H. of Dak., p. 443, Pl. XIII, figs. 10-11.*Scaphites nodosus quadrangularis* GRABAU AND SHIMER, 1910, N. A. Index Fossils, II, p. 178, figs. 1429, 1430.*Acanthoscaphites nodosus quadrangularis* REESIDE, 1927, U. S. G. S. Prof. Paper 150, p. 32.

In his description of *Scaphites* (*Discoscaphites*) *nicolletii*, Meek lists *Scaphites* (*Ammonites* ?) *comprimus* Owen as a synonym.<sup>1</sup> Owen's figure of *S. comprimus* (Table 7, figure 4), and his description, quoted below, do not seem to the writers to agree with the characteristics assigned originally to *Ammonites nicolletii* by Morton, and later described more fully by Meek. Owen says of his *S. comprimus*: "Shell compressed and slightly boat-shaped. One volution visible, the rest concealed in the outer chamber. Surface ornamented with slightly curved costae which, on the chambered portion of the shell, are more than twice as far apart as on the terminal, deflected, non-chambered part. Every second or third rib runs to the inner margin; the intermediate ribs are formed by bifurcation which commences one-fourth to one-half the distance toward the periphery. A row of small, pointed tubercles, on either margin of the flattened dorsum; a row of flatter and more obscure tubercles, one-fourth of the distance from the inner margin of the convolutions."<sup>2</sup>

Morton mentions only one row of tubercles, that on the periphery, in his original description of *Scaphites nicolletii*, and only one is shown

<sup>1</sup>Meek, op. cit., p. 435.<sup>2</sup>Owen, op. cit., p. 580.

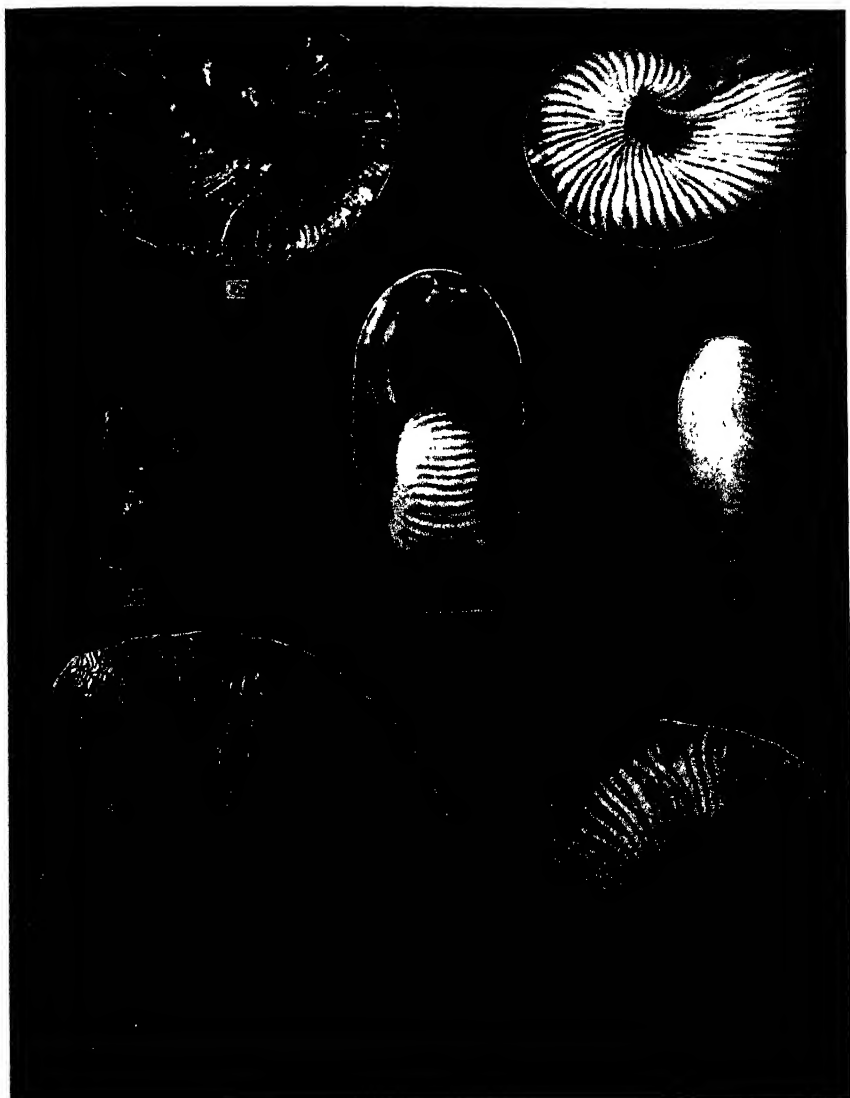


Fig. 5. *Acanthoscaphites nodosus comprimus*. Left side.  $\times 1$ .

Fig. 6. *Acanthoscaphites nodosus comprimus*. Venter, directly posterior to body whorl.  $\times 1$ .

Fig. 7. *Discoscaphites nicolletii*. After Morton, Jour. Acad. Nat. Sci. Phila., 1st Ser., VIII, pt. 2, Pl. x, fig. 3. (*Ammonites nicolletii*.)

Fig. 8. *Acanthoscaphites nodosus comprimus*. After Owen, Rept. of Geol. Surv. Wisc., Iowa and Minn., Tab. 7, fig. 4. (*Scaphites (Ammonites?) comprimus*.)

Fig. 9. *Acanthoscaphites nodosus quadrangularis*. After Meek, Invert. Cret. and Tert. Foss., Up. Mo., Pl. xxv, fig. 3a. (*Scaphites nodosus quadrangularis*.)



in the illustration.<sup>1</sup> Meek specifically states the fact that there is no inner row of nodes in this species. ". . . Costae everywhere without tubercles or nodes, excepting a single row along each side of the flattened periphery of the outer volution."<sup>2</sup> Owen, on the other hand, in both his verbal description, quoted above, and his figure, of *Scaphites comprimus*, distinctly indicates two rows of nodes, the inner one occurring near the umbilicus. His specimen also seems to be larger than is usual for the adult form of *S. nicolletii*, and the body chamber seems to be more deflected and to become freer at the aperture than that of *S. nicolletii* as described by Meek.

On the other hand, if Owen's description and figure of the species *S. comprimus* are compared with those of *Scaphites nodosus quadrangularis* as given by Meek,<sup>3</sup> a number of striking points of resemblance are found. The size of the shell as a whole, and the form and amount of deflection of the body chamber tally much more closely between the latter species and *S. comprimus* than they do between *S. comprimus* and *S. nicolletii*; the number, size and curvature of the ribs are more alike between the former two species, and the inner row of nodes on these two species seems to us to be identical in form, whereas *S. nicolletii* has none. Both *S. nodosus quadrangularis* and *S. comprimus* also have the periphery flattened in a more pronounced manner than does *S. nicolletii*, and the umbilicus of *S. comprimus*, according to Owen's figure, is larger than that of *S. nicolletii*, but the same as that of *S. nodosus quadrangularis*. Owen also has a figure of *S. nicolletii* in his report (Tab. 8, fig. 1), which resembles the original figure of Morton and the figure given by Meek, but does not resemble the figure of *S. comprimus* given by Owen in the same report.

Of course, one cannot tell certainly about the identity of Owen's species without having seen the suture, which Owen neither describes nor figures. However, as far as one can tell from external appearances, it seems to the writers that *S. comprimus* is identical with *S. nodosus quadrangularis* Meek and Hayden, rather than with *S. nicolletii* Morton. In this case, then, the name given by Owen should have precedence, having been given in 1852, while Meek and Hayden's name was not published until 1860. However, the authors feel that the form to which this name is applied should still be retained as a variety of *S. nodosus*, rather than as a separate species, which Owen originally considered it.

The figures referred to in the foregoing discussion are reproduced here as figures 7a and b, 8 and 9a and b of this paper.

<sup>1</sup>Morton, 1842. Jour. Acad. Nat. Sci. Phila., 1st. ser., VIII, pt. 2, p. 209, Pl. x, fig. 3.

<sup>2</sup>Meek, op. cit., p. 435.

<sup>3</sup>Meek, op. cit. p. 428; Pl. xxv, figs. 2, a-c; 3, a-c; 4.

***Acanthoscaphites nodosus crassus*, new variety**

. Figures 10, 11

TYPE.—A. M. N. H. Cat. No. 24234.

Shell attaining a large size, very ventricose, involute, with umbilicus about one-sixth as wide as the height of the shell. Inner volutions about equal in width and height. The mature body portion is much wider than high, except just posterior to the aperture, where it is constricted. The body chamber forms about half the entire bulk, and at the aperture is moderately free from the inner volutions. The venter is rounded throughout. The inner side of deflected portion of the coil is nearly straight, except with a slight dorsad swelling, corresponding to the most ventricose portion of the body chamber, just anterior to the umbilicus of the early whorls, and a slight sulcus, corresponding to the constriction of the body chamber, just posterior to the aperture, which makes an angle of 115 to 120 degrees with the straightened portion, if measured along their respective margins. The aperture is about equal in width and height, and it is characterized by the occurrence of a shallow, flattened, impressed zone on the dorsal side, and an evenly convexed and somewhat narrower portion on the ventral side.

The surface is ornamented with numerous fine, transverse costae, which increase by bifurcation and occasional intercalation so as to form about three times as many on the venter as on the flanks. The costae cross the venter with a moderate forward curvature. Each whorl also bears two rows of rather sharp nodes on each side; the inner row is situated near the umbilical shoulder, about one-sixth the distance from there to the ventral shoulder, on the inner whorls, and about one-third of the distance from the umbilical shoulder to the ventral shoulder on the body chamber. The outer row of nodes is situated approximately on the ventral shoulder. The nodes in each row are never more than one-half inch apart, even on the straightened, ventricose portion of the body chamber, where they are largest and most widely separated. Both rows are traceable from the very edge of the aperture backward as far as the whorls can be seen.

Greatest diameter of an apparently full-grown specimen is about 4.5 inches; the length, from the edge of the aperture backward along the venter as far as the volution can be followed, 13.25 inches. Greatest width (body chamber): 2.75 inches.

The sutures are deeply incised, with many slender branches and branchlets. The siphonal lobe is long and narrow, terminating in two main parallel branches, and bearing, about halfway to the base, on each



Fig. 10. *Acanthoscaphites nodosus crassus*. (n. var.). Left side.  $\times \frac{1}{5}$ .

Fig. 11. *Acanthoscaphites nodosus crassus*. (n. var.). Apertural view.  $\times \frac{1}{5}$ .

Fig. 12. *Acanthoscaphites duplico-nodosus*. (n. sp.). Right side (incomplete).

$\times 1$ .

Fig. 13. *Acanthoscaphites duplico-nodosus*. (n. sp.). Venter.  $\times 1$ .

side, a large, unequally bifid branch and several smaller trifold branches. The first lateral lobe is as wide, but not nearly so long, as the siphonal lobe; it ends in two unequally bifid branches, between which there are two small, simple projections. The second lateral lobe is much smaller in width and length than either of the foregoing; it appears to be trifold but on closer observation is seen to terminate in one nearly equally bifid branch and one very unequally bifid branch. There is a small trifold third lateral lobe, and a very small, slightly tridentate fourth lateral.

***Acanthoscaphites duplico-nodosus*, new species**

Figures 12, 13

The shell is medium-sized, very convex, involute but with a relatively larger umbilicus than in the preceding form; the volutions increase rapidly in size, especially near the apertural end. The surface is ornamented with rather coarse, sharp, transverse costae, some of which bifurcate before reaching the ventral shoulder, while others cross the venter without any bifurcation. There are also finer lines, between and parallel to the costae, which start from the umbilical margin and extend about half the distance from there to the ventral shoulder. Two rows of nodes are present on each side: an inner one near the umbilical shoulder, about one-third the distance from there to the ventral shoulder, and an outer row along the ventral shoulder. The nodes of the inner row are somewhat elongated transversely, and occur on about every other rib; they are evenly spaced and increase gradually in size toward the anterior end of the shell. In the outer row, the nodes are rounded and sharp, and are rather evenly spaced on the earlier part of the shell, occurring on about every fourth rib, but in the later stages of growth they appear in pairs, with one or two ribs between the members of each pair, and four to six ribs between the pairs. These double nodes are not confined to the gerontic body chamber, but begin to appear on the septate portion of the shell before the final chamber is reached. In our specimen, they first occur about two inches back from the anterior end, which is still septate. The inner row appears to be less extensive than the outer.

The greatest diameter of our specimen is about 2 inches. The greatest width is 1.25 inches.

The sutures are very deeply incised, and consist of very long, slender lobes, and deep, variously sinuate saddles. The lobes have a very narrow "body," that of the siphonal lobe, for instance, being only one-

seventh as wide as it is long; this lobe and the two lateral lobes on each side of it are all subdivided into numerous branches, and these in turn into many smaller branchlets, all of which are unusually long and slender.

This species is easily distinguished from others of the genus by its paired nodes and characteristic sutural features.





59.78 (728)

## TWO NEW FROGS FROM DARIEN

BY EMMETT REID DUNN<sup>1</sup>

Through the kindness of Dr. G. K. Noble, and with the assistance of a Grant-in-Aid from the National Research Council, I was enabled to examine the collection of reptiles and amphibians made in Darien in 1924 by C. M. Breder, Jr., while he was a member of the Marsh-Darien Expedition.

Having examined the Breder collection in The American Museum of Natural History, I have now seen practically all the herpetological material from Panama in existence in collections. The Breder collection is very rich in Salientia, but affords few novelties and few additions to the known fauna of Panama. It thus bears out a major conclusion already published, which is, that the herpetological fauna of Panama falls into two geographical groups: that of western Panama, and that of the Canal Zone and Darien. This agrees with the geography of the isthmus.

Two species of frogs in the collection are quite definitely new to North America. I have been unable to place them in any described South American species and consequently describe them here.

***Eleutherodactylus brederi*, new species**

TYPE.—A. M. N. H. No. 40523, collected April 26, 1924, by C. M. Breder, Jr.

TYPE LOCALITY.—Chalichiman's Creek, Darien, Panama, "a small mountain tributary draining into the Chucurti or Sucubti. It is close to the Continental Divide, just back of Caledonia Bay, and drains into the Chucunaque system."

RANGE.—Known only from type locality and from Río Chico, Darien (which "runs almost due west into the Chucunaque, joining it at Yavisa").

DIAGNOSIS.—An *Eleutherodactylus* of the *gollmeri-noblei* group, closely allied to *noblei* of western Panama and Costa Rica; disks developed only on two outer fingers; webs of feet rudimentary; sides of face dark; belly smooth; dorsal surface smooth save for dorsolateral glandular lines; inverted "V" markings on dorsum; heel reaching snout.

DESCRIPTION.—Head longer than broad; canthus rostralis marked; snout long, distance from eye to nostril greater than diameter of eye; tympanum  $\frac{3}{4}$  eye; vomerine teeth in two short, oblique rows, running in and back from a point near inner hind border of choanae; two outer fingers with enlarged disks; toes with slight web at

<sup>1</sup>Contributions from the Department of Biology, Haverford College, No. 22.



base; heel reaching snout; a dorsolateral glandular fold; finely shagreened above; belly smooth with a discoidal area; snout to vent 43 mm.; gray above, white below; a black line from snout through eye, which continues along glandular fold, and sends a branch down behind tympanum; a dark line between eyes; faint bars on sides; three inverted "V" marks on dorsum; faint barring on legs.

REMARKS.—Two other specimens, No. 41052, from type locality, and No. 41176, from Rio Chico, show no marked divergence.

This frog differs from the widely distributed *E. gollmeri* in the enlarged disks on the two outer fingers, in the dorsolateral fold, and in color. It agrees with *E. noblei* from Costa Rica and western Panama in the presence of the finger disks, but differs in dorsal markings, and in the presence of the dorsolateral fold. It may be considered as most closely related to *noblei*, and to be its representative in Darien.

### *Hyla subocularis*, new species

TYPE.—A. M. N. H. No. 41117, collected March 3, 1924, by C. M. Breder, Jr.

TYPE LOCALITY.—Rio Chucunaque, first creek above entrance of Rio Tuquasa.

RANGE.—Known only from type locality.

DIAGNOSIS.—A small *Hyla* with skin of head free; vomerine teeth in two small groups between the choanae and in line with their hind edges; snout short and blunt; tympanum indistinct,  $\frac{1}{2}$  eye; very distinct markings on head; fingers about one-third webbed; toes webbed almost to the disks of third and fifth.

DESCRIPTION.—Snout shorter than diameter of eye, blunt; canthus rostralis very marked; tympanum indistinct,  $\frac{1}{2}$  eye; vomerine teeth in two short linear groups between the choanae and in line with their hind borders; fingers webbed at base, about one-third; toes webbed nearly to disks of third and fifth; heel reaching to the anterior border of eye; smooth above; belly rugose; throat and chest smooth; a marked fold across chest; length 23 mm.; brown, a darker dorsal marking resembling an hourglass beginning between eyes; white below; head dark with a light line extending around snout on to shoulder, connecting on snout with the light edge of the upper lip; a dark dot in the light edge of snout; two light bars from eye to edge of lip, enclosing a bar of dark between them; a single narrow dark bar on shin; thigh with a light semicircular mark on a brown ground.

REMARKS.—Structurally this *Hyla* is similar to a number of other Central American forms, of which *underwoodi* is the most widespread. Several different forms resembling it are found in the high mountains of western Panama and Costa Rica. The head coloration is sufficient to distinguish it immediately from any of these.





# AMERICAN MUSEUM NOVITATES

Number 748

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

October 5, 1934

56.53,3 (114:76.6)

## SOME NEW OSTRACODES FROM THE "WHITE MOUND" SECTION OF THE HARAGAN SHALE, MURRAY COUNTY, OKLAHOMA

BY H. N. CORYELL<sup>1</sup> AND VIRGINIA A. CUSKLEY<sup>1</sup>

### INTRODUCTION

The species described in this paper were collected by Dr. H. N. Coryell in the summer of 1931 from the "White Mound" section of the Haragan shale, Murray Co., Oklahoma. In addition to the Ostracodes already described by Robert Roth,<sup>2</sup> eighteen more species were identified, seventeen of which are new. These are classified in eight genera, two of which are given here for the first time.

### STRATIGRAPHY

Outline showing the stratigraphic position of the Haragan shale according to the present conception.

Devonian { Oriskanian  
              Helderbergian—*Haragan shale*

The Haragan shale is the basal member of the upper half of the Hunton terrane of the Arbuckle Mountains, Oklahoma, as described by Chester A. Reeds.<sup>3</sup> He divides the Hunton into four formations on the basis of lithology and palaeontology. The bottom two divisions, the Chimneyhill limestone and the Henryhouse shale, are correlated with the Alexandrian and Niagaran beds of the Silurian respectively, and the upper two members, the Haragan shale and the Bois d'Arc limestone, are considered the equivalent of the New Scotland and Becraft of Lower Devonian age. The Haragan varies in thickness from 0-166 feet with an average thickness of about 100 feet and is not everywhere present with the other members. Reeds assigns the cause of this variation to unequal rate and time of deposition from place to place as well as to differential erosion during and following sedimentation.

The type section is the one at "White Mound," about three miles southeast of Dougherty. The formation takes its name from Haragan Creek which flows westward across the strike about one-quarter of a mile north of "White Mound."

<sup>1</sup>Department of Geology, Columbia University.

<sup>2</sup>Roth, Robert. 1929. 'Some Ostracodes from the Haragan Marl, Devonian of Oklahoma.' Jour. Paleon., III, No. 4, p. 327.

<sup>3</sup>Reeds, Chester A. 1911. 'The Hunton Formation of Oklahoma.' Amer. Jour. Sci., XXXII, pp. 256-268.

The Haragan is composed of alternating blue and white shales and thin-bedded, earthy limestones which become yellow on weathering.

On the basis of the macrofossils it has been correlated with the New Scotland of New York. It will be necessary to become acquainted with the microfossils from several other localities before one will have at command the necessary information to check the correlation on the basis of the smaller fossils. Eventually it is hoped that this will be possible.

#### CLASSIFICATION AND DESCRIPTION OF GENERA AND SPECIES

Family **KIRKBYIDAE** Ulrich and Bassler, 1906

Genus **KIRKBYELLA** Coryell and Booth, 1933

**Kirkbyella verticalis**, new species

Figure 1

Small, short, apparently equivalved, straight-hinged ostracode, subquadrangular in lateral view; dorsal margin straight; ventral margin approximately straight in middle portion, rounded at ends; posterior end bluntly rounded, anterior end with backward swing; surface covered with reticulations more oblong in ventral half and parallel to length; marked by a shallow vertical sulcus slightly posterior to the middle, extending from the dorsal margin to a subcentral pit; paralleling the ventral border is a broad swelling which narrows anteriorly and ends in a pronounced spine; running completely around the margin is a narrow, unreticulated border.

LENGTH.—0.62 mm. HEIGHT, 0.35 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24216.

**Kirkbyella obliqua**, new species

Figure 2

Carapace small, elongate, subquadrate in lateral view; dorsal contact straight; dorsal margin in lateral view rises above the hingeline in the anterior half; ventral margin approximately straight in the middle portion, rounded at ends; anterior end with backward swing; posterior end gently curved; surface covered with rather widely spaced pits forming a coarse series of reticulations more oblong in ventral half and parallel to the length; a shallow sulcus slightly posterior to the middle, extending obliquely from the dorsal margin to a subcentral pit, marks each valve; paralleling the ventral border is a broad swelling which narrows anteriorly and ends in a pronounced spine; running completely around the margin is a narrow, unreticulated border.

LENGTH.—0.75 mm. HEIGHT, 0.37 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24217.

This form differs from *Kirkbyella verticalis* in the more posterior position of the sulcus and more elongate form.

Family **PRIMITIIDAE** Ulrich and Bassler, 1923

Genus **BICORNELLA**, new genus

GENOTYPE.—*Bicornella tricornis*, new species

Small, inequivalved, straight-hinged ostracode, subovate in lateral view; left valve larger than right and overlapping along the free border; dorsal margin straight; ventral margin broadly convex; surface reticulate, marked by a deep sulcus in the dorsal half, on either side of which is a broad swelling which terminates in an anteriorly pointing spine; paralleling the ventral border is a broad, ill-defined swelling which terminates anteriorly in a slight spine.

**Bicornella tricornis**, new species

Figure 3

Carapace small, subovate with a slight backward swing; valves unequal, left larger than right and overlapping along the free border; dorsal margin straight; ventral margin convex; anterior margin curved with a slight backward swing; posterior broadly curved; surface finely and indistinctly reticulate, marked by a deep vertical sulcus in the dorsal half slightly behind the middle, on either side of which is a swelling that terminates in an anteriorly pointing spine; paralleling the ventral border is a broad, ill-defined swelling which terminates anteriorly in a slight spine.

LENGTH.—0.45 mm. HEIGHT, 0.25 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24218.

Genus **PARAHEALDIA**, new genus

GENOTYPE.—*Parahealdia pecorella*, new species

Small, apparently equivalved ostracodes, subovate in lateral view; hingeline straight; surface finely granulose or smooth, marked by a subcentral pit or sulcus and two backward pointing spines on the posterior end.

**Parahealdia pecorella**, new species

Figure 17

Small, elongate, apparently equivalved ostracode; dorsal border straight in middle portion, gently rounded at anterior and angulate at posterior ends; ventral border straight, curving gently at ends; anterior

rounded with ventral backward swing; dorso-posterior somewhat truncated; ventro-posterior curved; surface finely granulose, gently convex, with a pit in dorsal half slightly posterior of middle of the valve; shallow sulcus extends from the pit to the dorsal margin; near the extremities of the posterior height are two backward pointing spines, one dorsal and one ventral, connected by a distinct ridge, behind which the convexity of the valve slopes steeply to the posterior margin.

LENGTH.—0.65 mm. HEIGHT, 0.32 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24219.

***Parahealdia ovata*, new species**

Figure 18

Small, short, straight-hinged, apparently equivalved ostracode, subelliptical in lateral view; dorsal and ventral margins straight in middle portion; anterior end broadly curved; posterior dorsal margin truncated; posterior ventral end regularly curved; convexity of surface greater along ventral border; surface finely granulose, marked by a shallow pit in dorsal half, one-third height of shell from dorsal border and slightly posterior of the middle; near the posterior margin are two backward pointing spines, one dorsal and one ventral, connected by a low ridge, behind which the convexity slopes very steeply to the posterior margin.

LENGTH.—0.5 mm. HEIGHT, 0.32 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24220.

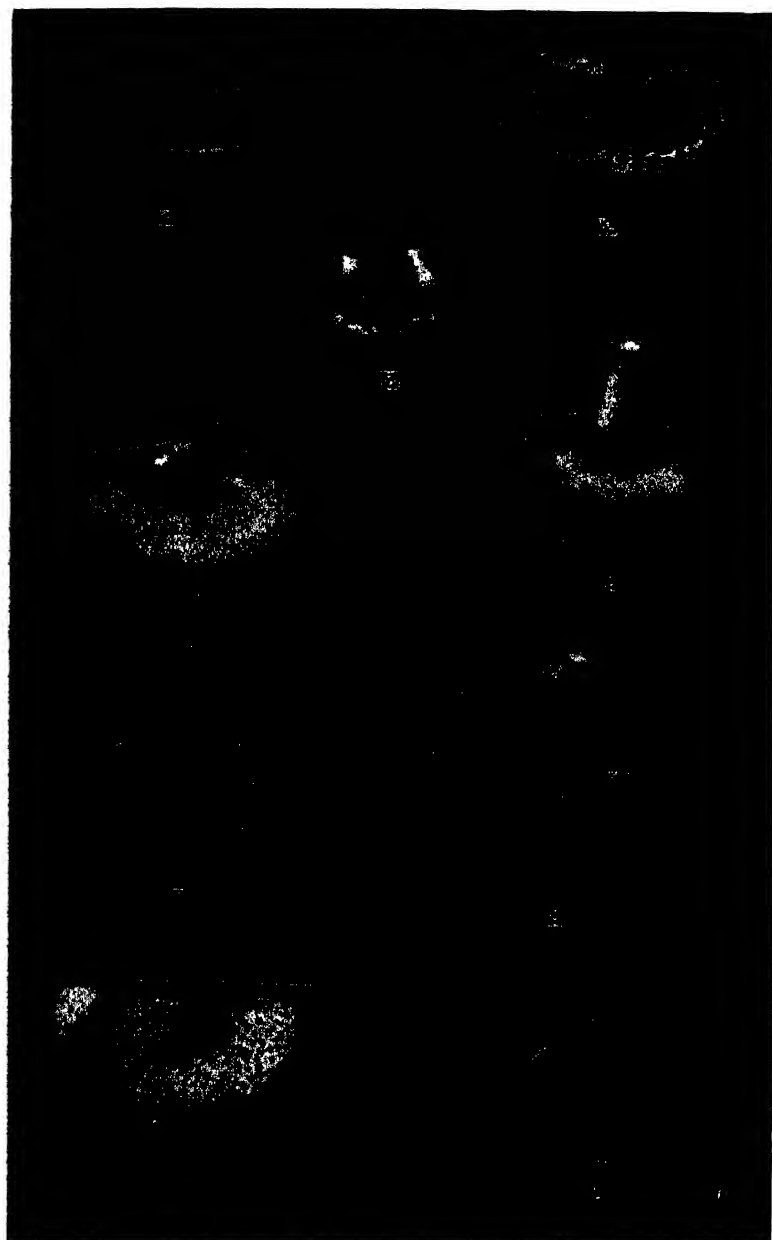
Genus ***Aechmina*** Jones and Holl, 1869

***Aechmina truncata*, new species**

Figure 4

Small, apparently equivalved ostracode, subrhomboidal in lateral view; hingeline straight, flush with dorsal margin; dorso-anterior and posterior margins straight; ventro-anterior narrowly curved, ventro-posterior more broadly curved; ventral margin convex; anterior cardinal

- Fig. 1. *Kirkbyella verticalis*, n. sp. Right valve.  $\times 25$ . A.M. No. 24216.  
 Fig. 2. *Kirkbyella obliqua*, n. sp. Left valve.  $\times 25$ . A.M. No. 24217.  
 Fig. 3. *Bicornella tricornis*, n. g., n. sp. Left valve.  $\times 25$ . A.M. No. 24218.  
 Fig. 4. *Aechmina truncata*, n. sp. Left valve.  $\times 25$ . A.M. No. 24221.  
 Fig. 5. *Aechmina longispina*, n. sp. Right valve.  $\times 25$ . A.M. No. 24222.  
 Fig. 6. *Aechmina serrata*, n. sp. Right valve.  $\times 25$ . A.M. No. 24223.  
 Fig. 7. *Ulrichia circa*, n. sp. Right valve.  $\times 25$ . A.M. No. 24224.  
 Fig. 8. *Ulrichia reticulata*, n. sp. Right valve.  $\times 25$ . A.M. No. 24225.  
 Fig. 9. *Ctenobolbina granosa* Ulrich. Left valve.  $\times 25$ . A.M. No. 24233.





angle obtuse, larger than posterior cardinal angle, causing the anterior end to project out further than the posterior; surface granulose, moderately convex with greatest convexity in posterior ventral half; blunt spine pointing upward, outward and slightly anteriorly located in front of middle near dorsal margin of each valve; greatest height a little posterior of middle; greatest length median; greatest thickness about one-third length of shell from posterior.

LENGTH.—0.92 mm. HEIGHT, 0.52 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24221.

***Aechmina longispina*, new species**

Figure 5

Carapace subovate in lateral view with pronounced backward swing; dorsal margin straight; ventral broadly curved; greatest length median; greatest height a little posterior of the middle; greatest thickness in the posterior half of the shell; surface broadly convex with a broad-based, long spine located slightly posterior to the middle on the dorsal margin of each valve, pointing upward and somewhat anteriorly.

LENGTH.—0.62 mm. HEIGHT, 0.37 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24222.

Differs from *Aechmina geneae* Roth in general shape of carapace and greater length of spine; also in *Aechmina longispina* the base of the spine covers about one-fourth the surface of valve whereas in *Aechmina geneae* the spine is located very close to the dorsal border.

***Aechmina serrata*, new species**

Figure 6

Carapace suboblong in lateral view; hingeline straight; ventral margin convex; anterior end gently curved with slight backward swing; posterior broadly rounded; maximum length median; maximum height and thickness in the posterior half; surface granulose, slightly convex; ornamented by a dorsal spine located in the middle of each valve and pointing upward, outward and anteriorly.

LENGTH.—1.0 mm. HEIGHT, 0.6 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24223.

**Genus *ULRICHTIA* Jones, 1890**

***Ulrichia circa*, new species**

Figure 7

Small, straight-hinged, equivalved ostracode, subovate in lateral view; dorsal margin straight; ventral margin broadly convex; anterior and posterior ends gently rounded; greatest height in posterior half;

greatest length one-third height of shell from ventral border; surface reticulate; marked by a small sulcus in the anterior half which slants posteriorly from the dorsal margin for a short distance; on either side of the sulcus is a node; the posterior is the larger and more prominent and extends above the dorsal margin; the anterior is smaller and situated a little below the dorsal margin; the distance from the posterior node to posterior end is twice that from the anterior node to anterior end; a false border extends around the free margin.

LENGTH.—0.50 mm. HEIGHT, 0.37 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24224.

***Ulrichia reticulata*, new species**

Figure 8

Small, straight-hinged, equivalved ostracode; dorsal margin straight; ventral convex; posterior end gently curved; posterior more acutely rounded; greatest length median; greatest height slightly posterior to the middle; surface reticulate, marked by a posteriorly directed sulcus located anterior to the middle; on either side of the sulcus is a node; the posterior is the more prominent and extends above the dorsal margin; a false border is present around the free margin.

LENGTH.—0.55 mm. HEIGHT, 0.37 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24225.

Family **BEYRICHIIDAE** Ulrich, 1894

Genus **CTENOBOLBINA** Ulrich, 1890

***Ctenobolbina granosa*** Ulrich, 1900

Figure 9

*Ctenobolbina granosa*, E. O. ULRICH, Jour. Cinn. Soc. Nat. Hist., XIX, No. 6, p. 183, Pl. VIII, fig. 12. ULRICH AND BASSLER, 1908, Proc. U. S. Nat. Mus., XXXV, p. 308, Pl. XL, fig. 12.

Small, straight-hinged, equivalved ostracode, subquadrate in lateral view; dorsal margin straight; ventral margin convex; posterior end gently curved; anterior more sharply rounded; anterior cardinal angle more obtuse than the posterior; surface granulose, marked by a deeply impressed sulcus which extends from the middle of the dorsal margin to the middle of the valve and points anteriorly; extending along two-thirds the ventral border from the posterior is a frill with five scallops.

LENGTH.—0.75 mm. HEIGHT, 0.55 mm.

PLESIOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24233.

Family **THLIPSURIDAE** Ulrich, 1900

*Thlipsuridae*, E. O. ULRICH in Eastman-Zittel, 1900, 'Textbook of Palaeontology,' p. 645. JONES, 1887, Ann. Mag. Nat. Hist., Ser. 5, XIX, p. 403, used the group word *Thlipsurae* and did not use the family name as commonly credited to him.

Genus **THLIPSURELLA** Swartz, 1932***Thlipsurella putea***, new species

## Figure 10

Carapace thick, subreniform in lateral view, sublong in dorsal view; dorsal margin strongly arched; ventral margin slightly concave; anterior end bluntly curved; posterior end a little more angulate; overlap small, the right valve overlapping the left along the entire margin; greatest height in front of the middle, greatest length nearer ventral than dorsal margin; greatest thickness in the anterior half; surface of valves granulose, convexity centrally flattened, abruptly elevated in front, descending more steeply to the ventral than to dorsal and posterior margins; marked by a deeply impressed, nearly vertical median furrow that extends from a little below the middle of the valve to about one-fourth the distance below the dorsal margin, where a short shallow extension of the cleft suddenly flares forward; anteriorly there is a system of four, subquadrangularly arranged, deep pits, each horizontal pair being noticeably confluent, the ridge between the two pairs more strongly elevated; anterior pits are larger than posterior; surface surrounding the pits forms a continuous rim which is curved except anteriorly where it is straight, running back obliquely from ventral to dorsal; anterior extremities of curved portion of rim end in short, blunt spines, one dorsal and one ventral; behind the median sulcus are two smaller pits, the long direction of the ventral one paralleling the posterior ventral border, while the long axis of the dorsal one is nearly vertical; a narrow flange occurs along the margin except on the anterior dorsal portion; the flange is more pronounced on the posterior end.

LENGTH.—0.67 mm. HEIGHT, 0.37 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24226.

Fig. 10. *Thlipsurella putea*, n. sp. Left valve.  $\times 25$ . A.M. No. 24226.

Fig. 11. *Condacypris acuminata*, n. sp. Left valve.  $\times 20$ . A.M. No. 24227.

Fig. 12. *Condacypris arcuata*, n. sp. Right valve.  $\times 16$ . A.M. No. 24228.

Fig. 13. *Condacypris parallela*, n. sp. Right valve.  $\times 10$ . A.M. No. 24229.

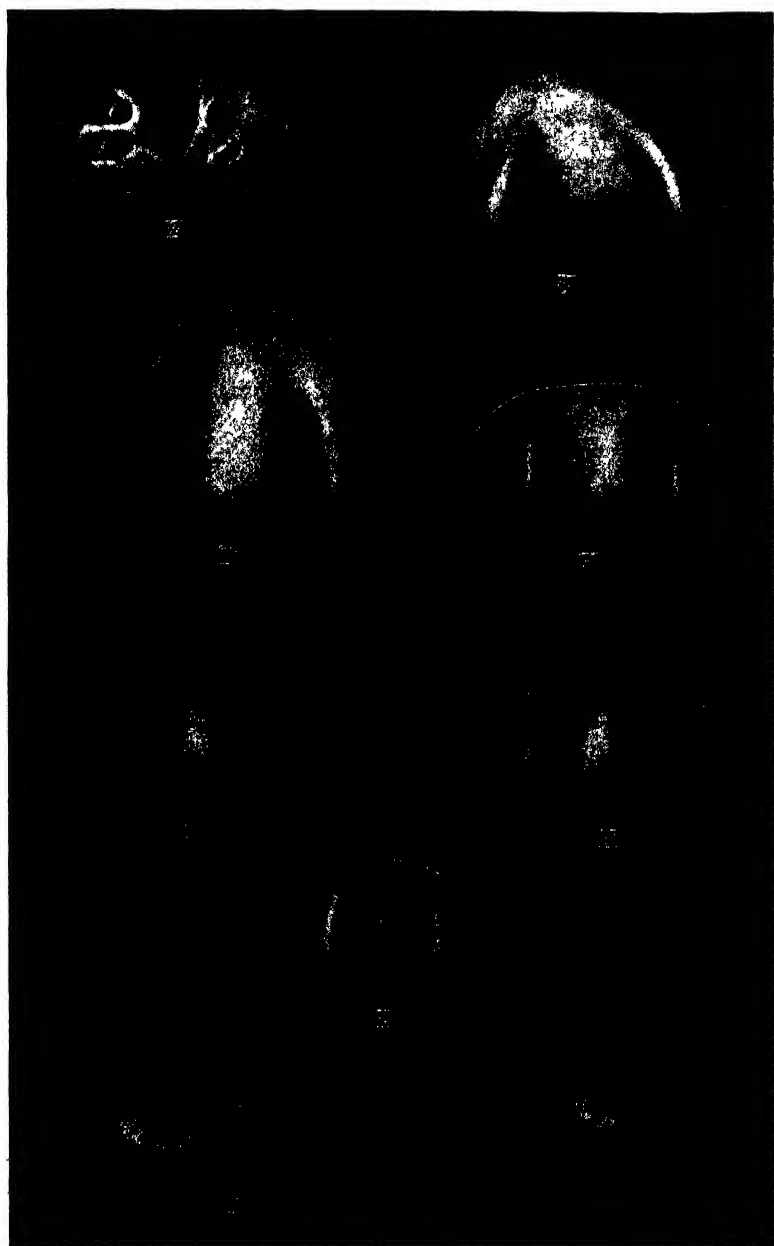
Fig. 14. *Condacypris elongata*, n. sp. Right valve.  $\times 10$ . A.M. No. 24230.

Fig. 15. *Condacypris hemispherica*, n. sp. Left valve.  $\times 10$ . A.M. No. 24231.

Fig. 16. *Condacypris similis*, n. sp. Right valve.  $\times 10$ . A.M. No. 24232.

Fig. 17. *Parahealdia peccorella*, n. sp. Left valve.  $\times 14$ . A.M. No. 24219.

Fig. 18. *Parahealdia ovata*, n. sp. Left valve.  $\times 16$ . A.M. No. 24220.



Family **CYPRIDAE** Baird, 1849Genus **CONDRACTYPRIS** Roth, 1929

*Condactypris*, ROBERT ROTH, 1929, Jour. Paleontology, III, No. 4, p. 370.

GENOTYPE.—*Condactypris binoda* Roth (here designated), 1929, Jour. Paleontology, III, No. 4, p. 370, Pl. xxxviii, fig. 28a (not 28b, c).

General outline subtriangular to subrectangular in lateral view; inequivalved, the left overlapping the right slightly; dorsal margin arcuate; ventral border straight or slightly concave, surface ornamented by two transverse ridges on each valve, extending from the dorsal margin nearly to the ventral and converging dorsally.

In orienting the species of this genus, the maximum height has been placed anteriorly as in Roth's discussion of *Condactypris binoda*.

**Condactypris acuminata**, new species

## Figure 11

Carapace subtriangular in lateral view; dorsal margin arcuate, sloping steeply in anterior half; postero-dorsal depressed and truncated; ventral margin slightly concave; anterior end narrowly rounded; posterior subacuminate; greatest height slightly anterior to the middle; greatest length just above the ventral margin; surface marked by two transverse ridges converging toward dorsal margin, the anterior situated about one-fourth and the posterior about one-fifth the length of shell from the respective ends; anterior ridge appears the longer as the posterior converges dorsally with the truncated margin; ridges die out before reaching either dorsal or ventral margins.

LENGTH.—1.4 mm. HEIGHT, 0.85 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24227.

**Condactypris arcuata**, new species

## Figure 12

Carapace subtrapezoidal in lateral view; dorso-posterior and anterior margins arched in broad curve; ventral margin straight, slightly depressed in region of maximum height; antero-ventral bluntly curved; postero-ventral angulated; maximum height somewhat anterior of middle; maximum length very close to ventral border; maximum thickness in posterior half; surface marked by two transverse ridges which converge dorsally, neither ridge meeting dorsal or ventral margin; posterior ridge occurs conspicuously further from the posterior border than the anterior from the anterior border and has the greater dorsal extension.

LENGTH.—1.6 mm. HEIGHT, 0.92 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24228.

***Condacypris parallela*, new species**

## Figure 13

Carapace elongate, subtrapezoidal in lateral view; dorsal margin broadly arched, dipping more steeply anteriorly than posteriorly; ventral margin straight, slightly depressed in region of maximum height; anterior end narrowly curved; posterior end truncated dorsally and bluntly rounded ventrally, meeting the ventral margin nearly perpendicularly; greatest length almost twice the height and located in the ventral half; height of posterior end greater than that of the anterior end; surface marked by two transverse ridges which converge dorsally.

LENGTH.—1.95 mm. HEIGHT, 1.05 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24229.

*Condacypris parallela* differs from *Condacypris arcuata* in the length-height ratio.

***Condacypris elongata*, new species**

## Figure 14

Carapace elongate, the greatest length twice the height, subquad-rangular in lateral view; posterior dorsal margin nearly straight; antero-dorsal margin broadly arched; ventral margin straight; anterior end narrowly rounded; posterior end nearly vertical in a broad curve, meeting the dorsal border in a sharp curve; maximum height anterior to the middle; posterior height much greater than the anterior and slightly less than the maximum height; maximum length just below the median line; surface strongly convex, the sharpest convexity being close to the dorsal and ventral borders; marked by two transverse ridges which converge slightly dorsally.

LENGTH.—1.95 mm. HEIGHT, 0.97 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24230.

***Condacypris hemispherica*, new species**

## Figure 15

Carapace short, subtrapezoidal in lateral view; dorsal margin arched; the highest point in the arch is anterior to the middle; the anterior slope is shorter and also steeper than the posterior, since the posterior height is nearly one and one-half times the anterior; ventral margin nearly straight; anterior end abruptly curved, posterior less abruptly so; maximum length close to ventral border; maximum height slightly anterior to the middle; surface is convex, with greatest con-

vexity close to dorsal and ventral borders and is marked by two transverse ridges which converge slightly dorsally.

LENGTH.—1.7 mm. HEIGHT, 1.1 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24231.

***Condacypris similaris*, new species**

Figure 16

Carapace small, subtrapezoidal in lateral view; dorsal margin arched, the highest point of arch anterior to middle; dorsal anterior slope truncated; dorsal posterior gently convex; postero-ventral contact angulated; anterior end curved at venter; ventral margin straight, slightly depressed in region of maximum height; greatest height anterior to middle; greatest length near the middle of the ventral half; surface marked by two transverse ridges which converge dorsally, posterior ridge with greater dorsal extension.

LENGTH.—1.6 mm. HEIGHT, 0.9 mm.

HOLOTYPE.—Amer. Mus. Nat. Hist. Cat. No. 24232.

# AMERICAN MUSEUM NOVITATES

Number 749

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

Oct. 8, 1934

56.9, 72 R (1183: 54)

## A NEW RHINOCEROS FROM THE SIWALIK BEDS OF INDIA

BY EDWIN H. COLBERT

### INTRODUCTION

The collection of fossil mammals obtained by Dr. Barnum Brown from the Siwalik series of northern India, for The American Museum of Natural History, contains a representative group of rhinocerotid remains, among which are some specimens from the Lower Siwaliks, that would seem to be indicative of a new genus and species of the Rhinocerotidae. These specimens consist of a very fine skull and some teeth, which will be described in the following pages. The illustrations for this paper are made from photographs taken by Hugh Rice and retouched by Louise Waller Germann.

### DESCRIPTION

#### **GAINDATHERIUM**,<sup>1</sup> new genus

An Upper Tertiary rhinoceros of medium size, with a "saddle shaped" skull having a single horn on the nasals, and with brachyodont, simple molar teeth. The orbit is located in an approximately central position above the first molar; the occiput is vertical; the postglenoid and post-tympanic are fused, forming a closed tube for the external auditory meatus. There are two upper incisors, of which the lateral one is quite small; the upper molars are without an antecrochet or a crista, and the crochet is but slightly developed.

GENERIC TYPE.—**Gaindatherium browni**, new species.

#### **Gaindatherium browni**,<sup>2</sup> new genus and species

TYPE.—Amer. Mus. No. 19409, an almost complete skull. From the Lower Siwaliks, Chinji zone, near Chinji Rest House, Salt Range, Attock District, Punjab.

#### PARATYPES.—

Amer. Mus. No. 29838, associated right and left upper and lower dentitions. From the Lower Siwaliks, Chinji zone, near Chinji Rest House, Salt Range, Attock District, Punjab.

Amer. Mus. No. 19471, a mandibular symphysis, with right I<sub>2</sub>, and right P<sub>3</sub>-M<sub>1</sub>, badly crushed. From the lower portion of the Middle Siwaliks, Nagri zone, 1000 feet below the bone beds at Bhandar. One mile south of Nathot, Salt Range, Jhelum

<sup>1</sup>From *Gainda*, a Hindustani word for the rhinoceros, and *therion*, meaning beast.

<sup>2</sup>Named in honor of Barnum Brown, who made the Siwalik collection for the American Museum.



District, Punjab. This specimen is provisionally referred to the species under consideration.

Amer. Mus. No. 29793, an upper incisor tooth. From the Lower Siwaliks, Chinji zone, about 500 feet above the level of Chinji Rest House. One and one-half miles west of Chinji Rest House, Salt Range, Attock District, Punjab.

HORIZON AND LOCALITY.—From the Lower Siwaliks, Chinji zone. The species may, however, extend up into the lower portion of the Middle Siwaliks, that is, into the Nagri zone. It is, however, typically of Chinji age. The locality is near Chinji Rest House, south of Chinji village, Salt Range, Attock District, Punjab.

DIAGNOSIS.—The specific diagnosis is the same as the generic diagnosis, presented above.

### THE SKULL

The rather striking resemblance of the skull of this new form, as exemplified by Amer. Mus. No. 19409, to the skull of *Dicerorhinus sumatrensis*, a similarity due to the relatively primitive character of both species rather than to a linear phylogenetic relationship, is at once apparent when the two species are compared. A careful study of the specimen under consideration will show, however, that it presents many basic resemblances to *Rhinoceros unicornis*, and the comparisons of the fossil to the modern Indian rhinoceros, as well as to the Sumatran form, will be brought out in the succeeding paragraphs.

As seen from the side, the cranial profile of this new Siwalik skull is saddle-shaped, a fact pointed out in the diagnosis, with the nasals and the occipital region rising considerably above the supraorbital portion of the frontals. This at once suggests the possible affinities of the fossil with the modern genus *Rhinoceros*. The nasals are quite convex and transversely broad, and their upper surface is pitted for the attachment of a strong "horn." There are no evidences whatsoever of the presence of a frontal horn.

The anterior border of the orbit is located almost exactly midway between the front and the back of the skull, and directly above the middle of the first molar. Here we see the expression of a primitive and an ancestral trait, denoting the central position evidently occupied by this new form in the phylogeny of the oriental forms leading up to *Rhinoceros*. In *Dicerorhinus sumatrensis* the anterior border of the orbit is above the second molar, a shift to the posterior portion of the skull which becomes quite characteristic of the *Diceros-Coelodonta* line. In *Rhinoceros sondaicus* and *Rhinoceros unicornis*, on the other hand, the anterior border of the orbit is above the fourth premolar, and is consequently advanced towards the front of the skull. The accompanying table will demonstrate the ratios of preorbital to postorbital lengths in the rhinoceroses mentioned above.

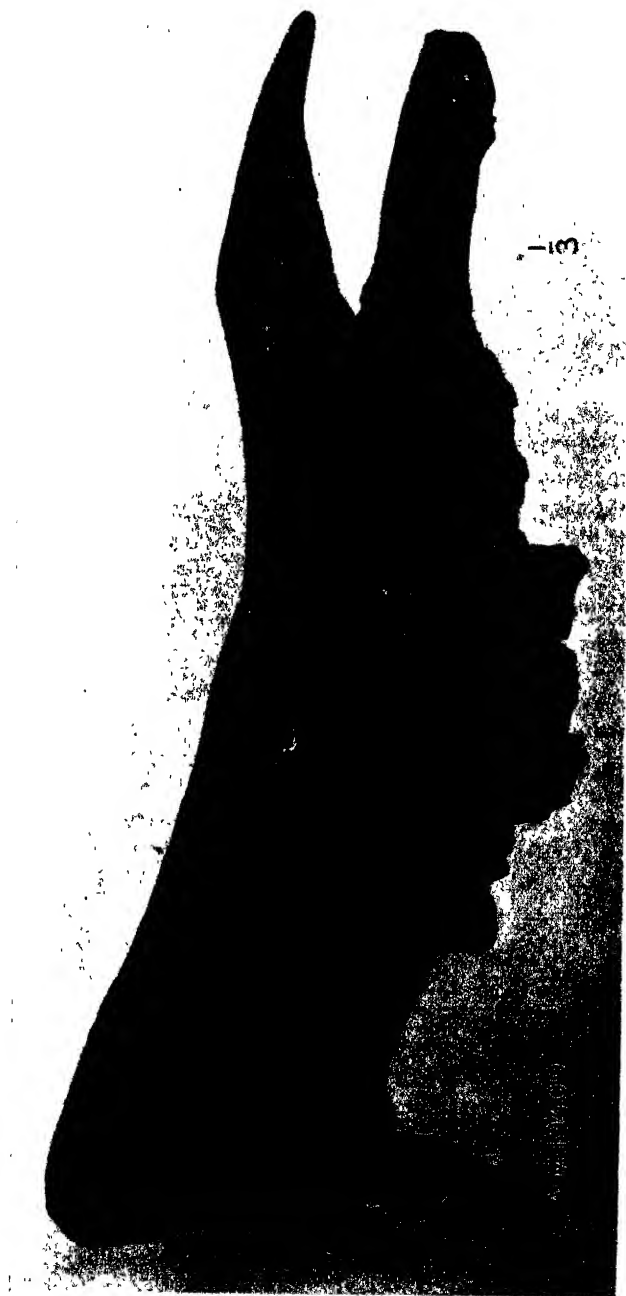


Fig. 1. *Gaioadatherium browni*, new genus and species. Type, Amer. Mus. No. 19409. Skull, lateral view. One-third natural size.

TABLE, PREORBITAL—POSTORBITAL RATIOS

	Preorbital length	Postorbital length	Ratio $\frac{\text{Preorb.}}{\text{Postorb.}} \times 100$
<i>Gaindatherium browni</i>			
Amer. Mus. No. 19409	260 mm.	290 mm.	90
<i>Dicerorhinus sumatrensis</i>			
(Osborn, H.F. 1898, fig. 14)	230	287	80
<i>Rhinoceros sondaicus</i>			
(Osborn, H. F. 1898, fig. 14)	285	385	74
<i>Rhinoceros unicornis</i>			
Amer. Mus. Mam. No. 54455	265	390	68

The skull appears to be rather low, an illusion probably strengthened because of a certain amount of crushing that it has undergone. The narial notch extends back to a point above the first premolar, and it is bounded below by the maxilla and the premaxilla, which latter reaches as far anteriorly as do the nasals. The premaxillaries are very slender and long. The zygomatic arch curves gracefully upward, from front to back, and it is comparatively slender.

The occiput is rather vertical, which would be expected in a primitive form comparable with *Caenopus* or *Dicerorhinus*. In the more specialized rhinoceroses the occiput becomes either forwardly inclined, as in *Rhinoceros unicornis*, or it overhangs the condyles as in *Ceratotherium simum*. Two parietal ridges run back from above the orbits, coming almost together just in front of the lambdoidal crest, thus forming a low, incipient sagittal crest. This again is an indication of the relatively primitive structure of *Gaindatherium*, for in the more specialized rhinoceroses, in which the brain case has become expanded, the parietal crests are separated from each other.

Looking at the ventral surface of the skull we see that the anterior palatine foramina (incisor foramina) are confluent, and they form a large opening, though relatively smaller than is the case in *Rhinoceros unicornis*. The posterior nares are very wide and they extend forward to a point opposite the anterior border of the second molar, a resemblance to the Indian rhinoceros. The pterygoids and the vomer are heavy.

Owing to the fact that the basicranium is mutilated, a detailed description of it can not be given.

As in other genera belonging to the Rhinocerotidae, the postglenoid process is very long, and it is situated medially, that is, towards the midline of the skull and somewhat internal to the glenoids, thus affording a strong mandibular articulation capable of free movement. The



Fig. 2.—*Gaiadatherium browni*, new genus and species. Type, Amer. Mus. No. 19409. Skull, dorsal view. One-third natural size.

postglenoid is joined with the post-tympanic, forming an enclosed tube for the external auditory meatus. In this last feature, *Gaioindatherium* is similar to *Rhinoceros*, and is more advanced than *Dicerorhinus*.

The fusion of the post-tympanic and the postglenoid occurs independently in various lines of rhinocerotid evolution, and must therefore be regarded as an habitus character indicating narrow but not broad phylogenetic relationships. The fusion of the postglenoid and the post-tympanic is seemingly indicative of relationships within a subfamily, but it would not seem to be of sufficient constancy to warrant the establishment of ties *between* subfamilies.

This coalescence of the postglenoid and the post-tympanic may probably be due in some part to the development and the action of certain muscles, such as the digastricus, rectus capitis lateralis, obliquus capitis superior and the longissimus capitis, that attach to the par-occipital process and the mastoid region. Just what the underlying causes of the differences existing in this region of the rhinoceros skull may be, is as yet an open question. That this fusion is probably a result of function rather than of size may be implied from the fact that certain very large rhinoceroses have the external auditory meatus open below, while in other smaller forms, like the one under consideration, the fusion of the two elements is complete. Of course, the fusion of the postglenoid and the post-tympanic may be due in part to inherent hereditary tendencies, that find different expressions in the several phylogenetic lines among the Rhinocerotidae. The answer to this perplexing question may be found in a future detailed study of the basicranium among the fossil and recent rhinoceroses.

#### THE DENTITION

Unfortunately, only the molars are present in the type specimen. The alveoli of the other teeth are well preserved, and they offer some clue as to the remainder of the dentition.

An interesting feature in this species is the fact that two incisor teeth were present, evidently I<sup>1</sup> and I<sup>2</sup>. The first incisor is a laniary tooth, as is common among the Rhinocerotidae. The second incisor is seemingly small, and evidently on the verge of disappearing.

The molar teeth, as shown in the type skull, are brachyodont and rather simple, being characterized by the complete absence of an antero-crochet or a crista, while the crochet is present in the last molar but is not strongly developed. The parastyle is prominent. There are anterior and posterior cingula, but none internally.



Fig. 3.—*Gaiadatherium browni*, new genus and species. Type, Amer. Mus. No. 19409. Skull, ventral view. One-third natural size.

A.M.19409

$\frac{1}{2}$



A.M.29838



A.M.29793

Fig. 4.—*Gaioindatherium browni*, new genus and species. Upper and lower dentitions. At top: Type, Amer. Mus. No. 19409, left  $M^{1-3}$ , crown view. In middle: Amer. Mus. No. 29838, left  $P^1-M^3$ , crown view. At bottom: Amer. Mus. No. 29838, right  $P_2-M_2$ , crown view, and Amer. Mus. No. 29793, upper incisor, lateral view. All figures one-half natural size.

Another specimen, Amer. Mus. No. 29838, shows the characters of the premolars and of the lower grinding dentition. The premolars are, with the exception of the first one, essentially molariform in pattern. The first premolar is small and triangular. It might be well to say that the molars and premolars in this species are rather broad transversely, as compared with their anteroposterior length.

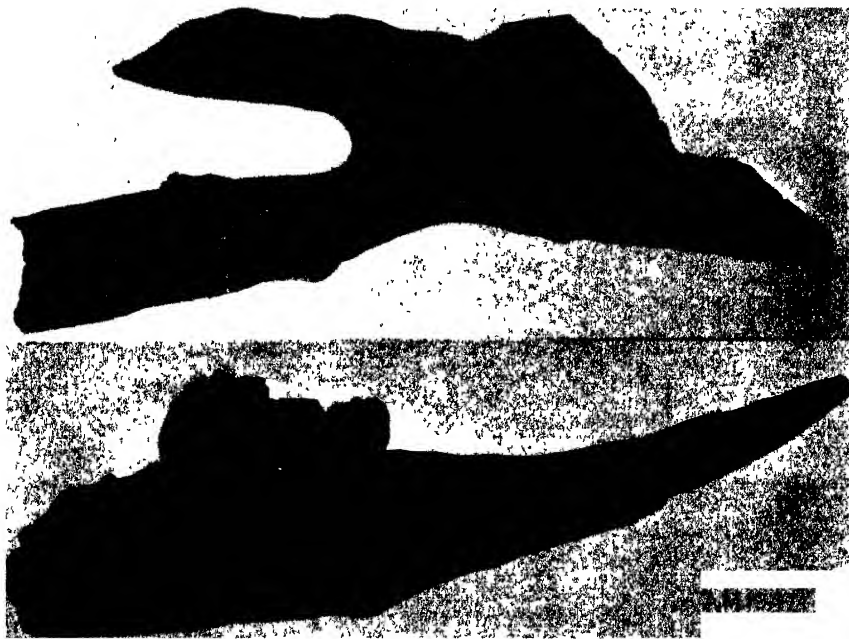


Fig. 5.—*Gaiндatherium browni*, new genus and species. Amer. Mus. No. 19471, symphysis of mandible. Superior view above, lateral view below. One-third natural size.

Coming now to the lower dentition, we see that it follows the usual rhinocerotid form. The first premolar is absent; the second one is small and narrow. The succeeding premolars and the molars consist of the usual anterior and posterior crescents.

A mandibular symphysis, Amer. Mus. No. 19471, from the lower portion of the Middle Siwalik beds is here referred to *Gaiндatherium*. The specimen is crushed, and the three cheek teeth present are badly



broken, making its identification somewhat problematical. This specimen is assigned to *Gaindatherium*, rather than to *Chilotherium* (the genus most abundantly found in these deposits), because of the general shape of the symphysis, which is rather narrow and shallow, and somewhat constricted anterior to the cheek teeth. Its general form is similar to the form of the mandibular symphysis in *Rhinoceros*. In *Chilotherium* the symphysis is very broad, deep and heavy. Moreover, the premolar-incisor diastema is of a length proper for *Gaindatherium*. Then again, the wear surface on the incisor is similar to that in the modern *Rhinoceros*, that is, it is comparatively short. In *Chilotherium* this surface is long. Furthermore, the general shape of the incisor in this supposed *Gaindatherium* jaw is more like that of the incisor of *Rhinoceros* than it is like the incisor of *Chilotherium*.

The various structural characters of the dentition of *Gaindatherium*, discussed above, are illustrated by the accompanying figures.

#### MEASUREMENTS

##### *Gaindatherium browni*, new genus and species

Amer. Mus. No. 19409, type

##### SKULL

Length, lambdoidal crest to tip of nasals	496 mm.
Length, condyles to incisor alveolus (estimated)	520
Length, anterior border of orbit to incisor alveolus	243
Length, anterior border of orbit to condyles	290
Width at glenoids	298
Width of parietals, narrowest portion	93
Width of frontals, supraorbital	168
Width of palate at M <sup>1</sup>	68
M <sup>1</sup> length	40
width	51
M <sup>2</sup> length	42
width	52
M <sup>3</sup> length	37
width	48

Amer. Mus. No. 29838, paratype

	length	width
P <sup>1</sup>	19 mm.	22.5 mm.
P <sup>2</sup>	28	34.5
P <sup>3</sup>	32	43
P <sup>4</sup>	37	49
P <sub>2</sub>	28.5	21.5
P <sub>3</sub>	30	26
P <sub>4</sub>	36	28
M <sub>1</sub>	40	30
M <sub>2</sub>	43	28

*Gaindatherium browni*, Amer. Mus. No. 19471, mandibular symphysis.

Depth of symphysis at P <sub>2</sub>	66 mm.
Width of symphysis at narrowest part	79
Length of symphysis	135
Transverse diameter of incisor	39
Vertical diameter of incisor	27

## DISCUSSION

If the skull of *Gaindatherium browni* is considered in its entirety, and all of its anatomical characters are evaluated, we see that it is seemingly more closely related to the modern *Rhinoceros* than to any other genera of the Rhinocerotidae. Of course, *Gaindatherium*, being a relatively primitive rhinocerotid, shows certain resemblances to other generalized types, such as *Caenopus* or *Dicerorhinus*. These are the heritage characters, derived from a community of origin and carried over into forms evolving along divergent lines. On the other hand, many of the characters of *Gaindatherium* are of later origin, and these are the habitus characters that would seemingly ally it with *Rhinoceros*. These characters are listed below.

### A. HERITAGE CHARACTERS IN *Gaindatherium*

1. The light, slenderly built skull is an heritage character derived from an ancestor of relatively small size and slender proportions.
2. The centrally placed orbit is a character derived from a primitive ancestor. In the primitive perissodactyls the preorbital portion of the skull is approximately equal in length to the postorbital region. In advanced forms the orbit tends to lose its central position.
3. The slight sagittal crest is a primitive character, due to the fact that the brain case has not expanded to any great degree.
4. The vertical occiput is a primitive heritage character.
5. The presence of the second upper incisor is primitive.
6. The brachyodont, simple molars show the heritage characters of an ancestor similar to *Caenopus*.

### B. HABITUS CHARACTERS IN *Gaindatherium*

1. The "saddle shaped" skull is a definite advance towards *Rhinoceros*.
2. The presence of one nasal horn is an habitus character in the direction of *Rhinoceros*.
3. The union of the postglenoid and the post-tympanic is again an habitus character that is also found in *Rhinoceros*.
4. The presence of a crochet on the last molar in *Gaindatherium* is a character that would seem to point towards *Rhinoceros*. In the latter genus the crochet and crista are well developed, but the antecrochet is not distinct. In *Gaindatherium* the crochet is present on the last molar, and the antecrochet is not distinct.
5. The relatively narrow, shallow symphysis and the straight lower incisor would seem to be characters indicative of a relationship with *Rhinoceros*.

	Nasal and frontal horns Postglenoid and posttympanic separate External auditory meatus open below	Nasal horn Postglenoid and posttympanic fused External auditory meatus closed below
Advanced	<i>Coelodonta</i>   <i>Ceratotherium</i>   — <i>Diceros</i>	<i>Rhinoceros</i>     
Primitive	 — <i>Dicerorhinus</i>	 <i>Gaindatherium</i>
Ancestral	 — <i>Caenopus</i> —	 

## BIBLIOGRAPHY

- BREUNING, STEPHAN, 1924. 'Beiträge zur Stammesgeschichte der Rhinocerotidae.'  
Verhandl. der Zool.-Bot. Gesellsch., Wien, LXXIII, pp. 5-46.
- LYDEKKER, R. 1876. 'Molar Teeth and Other Remains of Mammalia.' *Pal. Indica*,  
(X) I, Pt. 2, pp. 26-29.
1881. 'Siwalik Rhinocerotidae.' *Pal. Indica*, (X) II, Pt. 1, pp. 28-42,  
Pls. v-vii.
- MATTHEW, W. D. 1929. 'Critical Observations upon Siwalik Mammals.' *Bull.*  
*Amer. Mus. Nat. Hist.*, LVI, p. 455.
1931. 'Critical Observations on the Phylogeny of the Rhinoceroses.'  
*Univ. of Calif. Publ., Bull. Dept. Geol. Sci.*, XX, No. 1, pp. 1-9.
1932. 'A Review of the Rhinoceroses with a Description of *Aphelops*.  
Material from the Pliocene of Texas.' *Univ. of Cal. Publ. Bull.*  
*Dept. Geol. Sci.*, XX, No. 12, pp. 411-419, 437-442.
- OSBORN, H. F. 1898. 'The Extinct Rhinoceroses.' *Mem. Amer. Mus. Nat. Hist.*,  
I, Pt. III, pp. 75-164, Pls. xiiA-xx.
1900. 'Phylogeny of the Rhinoceroses of Europe.' *Bull. Amer. Mus. Nat.*  
*Hist.*, XIII, pp. 229-267.
- RINGSTRÖM, TORSTEN. 1924. 'Nashörner der Hipparion-Fauna Nord Chinas.'  
*Geol. Surv. China, Pal. Sinica*, I, Fas. 4, pp. 1-156.
1927. 'Ueber Quartäre und Jungtertiäre Rhinocerotiden aus China und  
der Mongolei.' *Geol. Surv. China, Pal. Sinica*, IV, Fas. 3, pp. 1-21.
- VON ZITTEL, K. A. 1925. 'Textbook of Palaeontology.' III. (Translation by  
A. S. Woodward), pp. 137-143.



58.9, 71 (8)

PROVISIONAL CLASSIFICATION OF EXTINCT SOUTH  
AMERICAN HOOFED MAMMALS<sup>1</sup>

BY GEORGE GAYLORD SIMPSON

Since their discovery by Darwin over a century ago, the native ungulates of South America have enjoyed, or suffered, an unusually checkered taxonomic career. This distinction was guaranteed them by their puzzling morphological dualism. On one hand, they are remarkably exotic in comparison with the fossil or recent mammals of any other continent, and on the other they parallel these mammals in many features, now considered largely adaptive or secondary, in a way often amazing. Ameghino, the greatest authority, came to consider the resemblances as of prime importance, and his later classifications reflect these almost exclusively, but if his discussions are read it will be found that in most cases he also recognized and interpreted, on the whole correctly as now appears, those characters peculiar to the South American beasts. Most other students emphasize these more aberrant characters and base classification primarily on them. This now seems to be correct and necessary, but it places taxonomists in the embarrassing position of having to leave most South American groups hanging in the middle of the world classification with no visible means of support. The Ameghinoan method is intellectually more satisfying, but unfortunately it seems almost certainly to be farther from the truth.

No classification yet presented is very satisfactory, and none has any good chance of surviving very long. The same is true of the present attempt. But each brought out some new and useful feature. In the present case, aside from the effort to embody new discoveries in this field and new viewpoints in the general science, the principal feature is the consideration of the light cast on these problems by pre-Santa Cruz fossils. Except Ameghino, no one has previously been able to study these in detail and at first hand, and their evidence is of crucial importance in many if not most points. A great deal remains to be done, even with the material now in hand (especially that of the Scarritt Expeditions of 1930-31 and 1933-34), but already enough is known to demand some revision, and to invite its prompt publication in the hope of criticism and discus-

<sup>1</sup>Publications of the Scarritt Expeditions, No. 22.

sion. An attempt has also been made to digest the alarmingly extensive literature of the groups and incorporate the results in this trial sheet classification.

The groups here considered are those ungulate in the broadest sense which occur in South America previous to the Late Tertiary incursion of surely Holarctic types. Of this great assemblage not one trace survives. Every family and every order is extinct. The consensus is that only two groups are known from outside South America, the condylarths being typically Holarctic but also (I believe) present in the Eocene of South America, and the notoungulates of the new suborder Notioprogonia typically South American but, although scantily, indubitably represented also in North America and in Asia.

Renewed thanks are due to the authorities of the Museo Argentino de Ciencias Naturales<sup>1</sup> in Buenos Aires, and particularly to its director, Dr. M. Doello Jurado, for access to the Ameghino Collection and facilities for its study<sup>2</sup>, and also to H. S. Scarritt, E. S. Riggs and the Field Museum, and several others whose cooperation has incidentally been of great value in the present study although primarily granted in connection with the faunal revisions and other researches now in progress.

#### PREVIOUS CLASSIFICATIONS

From the many previous classifications of the groups here considered, those of Lydekker (1894), Ameghino (in its definitive form, 1906), Gregory (and Osborn, in Osborn 1910), Scott (in its definitive form, 1913), and Schlosser (1923) are selected to give some idea of typical opinions and taxonomic trends. Lydekker's classification represents essentially a broad European viewpoint, based on much personal study, progressive at the time but dating from near the beginning of the full flood of discovery, essentially the first modern classification. Ameghino's classification, one of the fruits of a life-time of excellent work, represents the mature opinion of the authority whose first-hand knowledge has not been equalled before or since, but also reflects a peculiarly narrow and personal point of view not shared by any other student. The Gregory system (edited and accepted by Osborn) represents a highly competent synthesis adapting the concrete data of Ameghino, and others, to the broad views more generally held, then and now, by European and North American students. Scott's classification, unquestionably the best available and in general here modified only as far as made necessary by

<sup>1</sup>Formerly the Museo Nacional de Historia Natural.

<sup>2</sup>A descriptive catalogue of the two earliest faunas is nearly completed.

subsequent extension of knowledge, represents first-hand study of the most typical forms from this broader point of view and with new data unknown to Ameghino. Schlosser's work, while including some unacceptable and peculiar personal points, is a widely used and relatively modern synthesis, which also involves some first hand acquaintance with the fossils.

LYDEKKER, 1894.

Order UNGULATA

Suborder TOXODONTIA

Pachyrucidae

Typotheriidae

Toxodontidae

Suborder ASTRAPOTHERIA

Homalodontotheriidae

Astrapotheriidae

Suborder LITOPTERNA

Protherotheriidae

Macrauchiidae

AMEGHINO, 1906.

\*PROSIMIAE

Archaeopithecidae

Notopithecidae

Henricosborniidae

\*HYOPSODONTIDAE

Clenialetidae

Eudiatidae

\*HYRACOIDEA

Acoelodidae

Archaeohyracidae

TYPOTHERIA

Eutrachytheriidae

Hegetotheriidae

Protypotheriidae

Typotheriidae

TOXODONTIA

Nesodontidae

Xotodontidae

Haplodontidae

Toxodontidae

\*HIPPOIDEA

Colpodontidae

Notohippidae

†CONDYLARTHRA

Pantostylopidae

\*Phenacodontidae

\*Catathleidae



- \*Pantolambdidae
- \*Arctocyonidae
- \*PERISSODACTYLA
  - \*Hyracotheriidae
  - \*Palaeotheriidae
  - Proterotheriidae
  - Macraucheniiidae
  - Adiantidae
- \*PROBOSCIDEA
  - Carolozitteliidae
  - Pyrotheriidae
- \*AMBLYPODA
  - Trigonostylopidae
  - Albertogaudryidae
  - Astrapotheriidae
  - \*Lophiodontidae
- \*ANCYLOPODA
  - Isotemnidae
  - Homalotheriidae
  - Leontiniidae
- \*TILLODONTA
  - Notostylopidae

[The classification is compiled from all Ameghino's separate faunal lists, but the grouping and succession are his. Groups marked \* are Holarctic and not now believed to occur in the early Tertiary of South America. That marked † is Holarctic, principally, but I agree that it does appear in South America.]

OSBORN, 1910. This arrangement was published by Osborn but is by him credited to Gregory. The classification published by Gregory (1910) in the same year differs, however, in considering the *Notoungulata* as an order, with the other super-family groups as suborders, in uniting the *Toxodontia* and *Typotheria* under the former name, and in recognizing the families *Henricosborniidae* (doubtful, in the "*Homalodotheria*"), *Nesodontidae*, and *Protypotheriidae*. Presumably these differences are due to Osborn's editing of the classification here copied.

- Order CONDYLARTHRA
  - Fam. *Inc.*
    - Didolodus*, etc.
- Superorder NOTOUNGULATA
  - Order TOXODONTIA
    - Suborder HOMALODOTHERIA
      - Notostylopidae
      - Homalodotheriidae
    - Suborder ASTRAPOTHERIA
      - Inc. sed.* Albertogaudryidae
      - Inc. sed.* Isotemnidae
      - Astrapotheriidae

## Suborder TOXODONTIA

*Inc. sed.* Archaeohyracidae

Toxodontidae

## Suborder TYPOTHERIA

Interatheriidae

Hegetotheriidae

Typotheriidae

## Order LITOPTERNA

Proterotheriidae

Macraucheniiidae

## Order PYROTHERIA

Pyrotheriidae

SCOTT, 1913. This nearly represents the present views of this authority, as his later work (e.g., 1932) changes a few details but in the main confirms his earlier opinions.

## Order TOXODONTIA

## Suborder TOXODONTA

Toxodontidae

Notohippidae

Leontiniidae

## Suborder TYPOTHERIA

Typotheriidae

Interatheriidae

Hegetotheriidae

Notopithecidae

Archaeopithecidae

Archaeohyracidae

## Suborder ENTELONYCHIA

Notostylopidae

Isotemnidae

Homalodontotheriidae

## Suborder PYROTHERIA

Pyrotheriidae

## Order ASTRAPOTHERIA

Astrapotheriidae

Trigonostylopidae

## Order LITOPTERNA

Macraucheniiidae

Proterotheriidae

Didolodidae

## SCHLOSSER, 1923.

## Order UNGULATA

## Suborder LITOPTERNA

Bunolipternidae<sup>1</sup>

Macraucheniiidae

<sup>1</sup>A curious and invalid emendation of Didolodidae Scott. There is no generic name on which this family name could be based.

- Protheroheriidae
- Adiantidae
- Suborder AMBLYPODA
- Pyrotheria<sup>1</sup>
- Order NOTOUNGULATA
- Suborder TYPOTHERIA
- Notopithecidae
- Interatheriidae
- Hegetotheriidae
- Typotheriidae
- Archaeopithecidae
- Archaeohyracidae
- Suborder TOXODONTIA
- Notohippidae
- Nesodontidae
- Toxodontidae
- Suborder ENTELONYCHIA
- Arctostylopidae
- Notostylopidae
- Isotemnidae
- Leontiniidae
- Homalodontotheriidae
- Suborder ASTRAPOTHERIOIDEA
- Trigonostylopidae
- Albertogaudryidae
- Astrapotheriidae

### NEW CLASSIFICATION

The following proposed classification is based on all those given above, and many others, as well as on study of original specimens. Of previous classifications, while each has its peculiar merits and marks a progressive step, that of Scott is worthy of special note, as it combines a first hand knowledge of the material equalled only by Ameghino with a broader and less biased viewpoint as well as the progress of science since Ameghino completed his work on this subject.<sup>2</sup> Any departure from Scott's arrangement requires special defense. The considerations on which the new arrangement is based are given below under the name of each major group.

Order CONDYLARTHRA Cope, 1881.

Didolodontidae Scott, 1913.<sup>3</sup>

<sup>1</sup>Given in this form as a family, an invalid procedure.

<sup>2</sup>Although Ameghino continued work until his death in 1911, his classification had reached its definitive form in all essentials by 1904.

<sup>3</sup>Emended from Didolodidae. I do not consider such an orthographic change as altering the authorship of the name.

- Order LITOPTERNA Ameghino, 1889.
  - Macraucheniiidae Gill, 1872.
  - Proterotheriidae Ameghino, 1887.
- Order NOTOUNGULATA, Roth, 1903.
  - Suborder NOTIOPROGONIA, new.
    - Arctostylopidae Schlosser, 1923.
    - Henricosborniidae Ameghino, 1901.
    - Notostylopidae Ameghino, 1897.
  - Suborder ENTELONYCHIA Ameghino, 1893.
    - Isotemnidae Ameghino, 1897.
    - Homalodotheriidae Ameghino, 1889.
  - Suborder TOXODONTA Owen, 1858.
    - Notohippidae Ameghino, 1894.
    - Toxodontidae Gervais, 1847.
    - ?Leontiniidae Ameghino, 1895.
  - Suborder TYPOTHERIA Zittel, 1893.
    - Notopithecidae Ameghino, 1897.
    - Interatheriidae Ameghino, 1887.
    - Typotheriidae Lydekker, 1886.
    - Hegetotheriidae Ameghino, 1894.
    - ?Archaeohyracidae Ameghino, 1897.
    - ?Acoelodidae Ameghino, 1901.
- Order ASTRAPOTHERIA Lydekker, 1894.
  - Suborder ASTRAPOTHERIOIDEA<sup>1</sup> Ameghino, 1894.
    - Astrapotheriidae Ameghino, 1887.
  - Suborder TRIGONOSTYLOPOIDEA, new.
    - Trigonostylopidae Ameghino, 1901.
- Order PYROTHERIA Ameghino, 1895.
  - Pyrotheriidae Ameghino, 1889.

### CONDYLARTHRA

Ameghino believed that many of his Casamayor and a few of his Musters and Deseado fossils represented the Condylarthra. While he was almost surely mistaken as regards some of these (e.g., the whole family Pantostylopidae, which I consider synonymous with the Henricosborniidae and true notoungulates), others are so like condylarths as to lend at least a strong suspicion that he was right. This resemblance has been recognized by most later students, but with few exceptions<sup>2</sup> they have more strongly emphasized the also real resemblance to the litopterns and have placed these genera in the Litopterna. After re-studying all of Ameghino's material and a number of other specimens, practically all that are known, I can find no definite characters which exclude *Didolodus* and its close allies from the Condylarthra. It is

<sup>1</sup>Emended from *Astrapotherioidea*.

<sup>2</sup>Roth, for instance, placed these genera in a distinct group *Didolodia* and denied litoptern affinities.

quite possible that they represent approximately an ancestral stage through which the litopterns passed, but in themselves they have no diagnostic litoptern characters. As knowledge of them is not very good, it is possible that the condylarthresemblance is not conclusive, but on the evidence now available it must be concluded that Ameghino was right and that this group must be classified in the Condylarthra. Their reference to the Phenacodontidae, however, seems to overemphasize the resemblance to Holarctic forms, and it seems best to retain the distinctive South American family Didolodontidae.

#### LITOPTERNA

Ameghino proposed the name Litopterna for an order (or suborder—the intention is not clear) of the group Perissodactyla, with approximately the contents now accepted except that the Homalodotheriidae were at first included. The latter surely extraneous element was later removed by Ameghino. Later (e.g., 1906) he abandoned the name Litopterna and simply referred the litoptern families Proterotheriidae and Macrauchiidae to the Perissodactyla. Other students, however, notably Scott in his definitive revision of the Santa Cruz forms (1910), did not accept the reference to the Perissodactyla and so retained the name Litopterna for an order or suborder sometimes placed with the notoungulates, and sometimes as a separate group of uncertain affinities. That the litopterns are a distinctive natural group with no near affinities with perissodactyls is now universally recognized, but there are many shades of opinion as to their nearness of relationship to the notoungulates. Some (e.g., Gregory 1910, Loomis 1914) place them within the Notoungulata. Others follow Scott (1910) in retaining them as a separate order, but one of common origin with the Notoungulata (his Toxodontia). Still others (e.g., Schlosser, 1923) reject any close connection with the notoungulates and emphasize the evidence of derivation from the condylarths.

As a matter of practical taxonomy, these forms should surely be placed in a separate Order Litopterna. As a matter of opinion, I do not see how their relationship with the notoungulates can be closer than through a condylarthran or condylarth-like, very remote common ancestor, which means little more than that they are all ungulates or “subungulates.”

The families Proterotheriidae and Macrauchiidae are certainly valid and universally recognized. The Didolodontidae have been removed to the Condylarthra, as stated above. The fourth supposed

family, *Adiantidae*, is so badly known as to have no real value and I prefer to follow Scott in tentatively uniting it with the *Macraucheniidae* at least until better known. In the *Casamayor*, especially, there are a few genera, most of them based on single teeth, which are of doubtful affinities and may eventually warrant family separation, but at present it seems better to distribute them tentatively in the *Proterotheriidae* and *Macraucheniidae*.

#### NOTOUNGULATA

The appropriate name *Notoungulata* ("Southern ungulates") was proposed by Roth (1903) on the basis of the peculiar structure of the temporal region especially noted in toxodonts and typotheres. Litopterns, astrapotheres, and pyrotheres were clearly excluded by the definition and intention of the author, and the notostylopids and homalodontotheres were explicitly included. As proposed, therefore, the group *Notoungulata* had exactly the same scope as that here given it, including *Notioprogonia* (hitherto part of the *Entelonychia*), *Entelonychia*, *Toxodonta*, and *Typotheria*. Scott (1904) preserved Roth's grouping, but applied to it the name *Toxodontia*, distinguished from the smaller group *Toxodonta*, and he also proposed to extend Roth's name *Notoungulata* to include the *Toxodontia* (in the *sensu lato* of Scott), the *Litopterna*, and the *Astrapotheria*. Later (see 1913), Scott dropped the name *Notoungulata*, made his Order *Toxodontia* include the suborders *Toxodonta*, *Typotheria*, *Entelonychia*, and *Pyrotheria*, and made separate orders of the *Astrapotheria* and *Litopterna*.

In this I cannot follow Scott. The use of *Toxodontia* and *Toxodonta* for two groups of different rank is not strictly invalid, but is inconvenient and is to be avoided if possible without confusion and without coining new names unnecessarily. *Toxodontia*, as proposed by Scott, was really an exact synonym of *Notoungulata* Roth, and I see no reason for rejecting the latter much less confusing and very appropriate name. Whether it is to be extended to include also groups at first excluded by Roth seems to be beside the point, and in any event there is no strong evidence for such extension at present. It is also beside the point that the group is now defined on a broader basis than used by Roth and that he may have overemphasized and to some extent misunderstood the ear and temporal region characters.<sup>1</sup>

<sup>1</sup>Scott (1932) recently suggests that if Order *Toxodontia* be raised to superordinal rank, Roth's name *Notoungulata* should be adopted. It is difficult for me to follow the logic of this proposal. No change of contents is proposed. It might be argued that a change of rank in itself warrants change of name (with which I strongly disagree), but Roth did not propose *Notoungulata* as a superorder, but explicitly as a suborder of the *Ungulata*, fully corresponding in usage with an order of ungulates in all modern classifications.

In the Notoungulata I include the now classical groups Entelonychia, Toxodonta, and Typotheria, as well as the new Notioprogonia, defined below.

### Suborder NOTIOPROGONIA<sup>1</sup> new

DISTRIBUTION.—Paleocene, Mongolia. Eocene, North and South America.

DIAGNOSIS.—An early suborder of Notoungulata, including some primitive, rather generalized forms and a few ancient divergent lines superficially specialized but basically primitive.

Dentition complete or with  $I\frac{3}{5}$   $C\frac{1}{1}$   $P\frac{1}{1}$  variously reduced. All cheek teeth brachyodont, without cement. Upper premolars progressively complicated, but all triangular or nearly so, with protocone at least on  $P^{2-4}$  and hypocone very feeble or absent. Upper molars transverse, with strong parastyle, well formed ectoloph and oblique protoloph, but metaloph variable and often imperfect. Crochet present, anteroposterior when elongated, and generally free of ectoloph. Other secondary folds or crests slight or absent.  $M^{1-2}$  quadrate, with strong hypocones, nearly or quite equal to protocones.  $M^3$  large but triangular, hypocone small or unrecognizable as such. Lower premolars essentially bicrescentic, with subequal trigonid and talonid. Lower molars with very short trigonids and long talonids. Trigonium essentially a single transverse lophid, anterior wing reduced, paraconid inconspicuous and median or relatively external. Talonids with a strong, elongate, crescentic lophid and simple, transverse, crested entoconid pillar, without secondary connections or crests.

Rostrum, as far as known, short, deep, and rather narrow. Nares terminal. Zygomata arising opposite anterior molars. Cranium (Notostylopidae, unknown in other families but probably similar) markedly triangular between squared zygomata. Strong postorbital constriction. Endocranial cast much in as typotheres, but more primitive. Ear region of generalized notoungulate type, epitympanic sinus relatively small, porus low, ossified meatus short and nearly horizontal, tympanic crested, hypotympanic sinus large and globular, extending far ventral to basisphenoid, cranio-facial flexion slight.

Mandible rather elongate and slender, tooth series nearly straight.

Although reluctant to add to an already burdensome nomenclature, the considerations given below and the more detailed data bearing on the structure and relationships of the several early groups of notoungulates lead to the conclusion that the creation of a fourth suborder of Notoungulata, here named Notioprogonia, is necessary for greatest clarity and simplicity of expression. The Notostylopidae are the best known of the notioprogonians, but here should also be included the families, still less specialized at least in the dentition, Henricosborniidae and Arctostylopidae. These seem to form a natural, varied group, on present evidence,

<sup>1</sup>*Notoprogonia*, southern, *επὶ βορρῶν*, ancestor, to suggest the primitive character of the group and its more or less archetypal relationships with the typically southern Notoungulata. There seems no possibility of confusion with *Notoprogonia*, which is a generic name, invalid (a synonym), and different in spelling, pronunciation, and derivation (*νέος*, south, *πρωτός*, first, *γωνία*, angle). Schlosser does list a "*Notoprogonia*," but even aside from derivation, spelling, and the question as to whether a generic name can preoccupy one of higher rank, this was an obvious misprint or error for *Notostylopia* (itself invalid) and has no standing in nomenclature.

and in general the Notioprogonia may at least tentatively include such early, primitive or only superficially specialized, short lived groups of notoungulates as have no clear and special relationships to one of the three other suborders, Toxodonta, Typotheria, and Entelonychia.

The affinities of the Arctostylopidae, aside from casual mention, have been discussed only by Matthew (1915) and by him only in a preliminary and brief way, without the benefit of the much richer material now at hand. Although referring *Arctostylops* to the Entelonychia, and even questionably to the family Isotemnidae, this was merely taxonomic conservatism and does not represent his expressed views as to general affinities. He compared this form chiefly with *Notostylops* and placed *Arctostylops* (and later *Palaeostylops*) in the Entelonychia largely because he accepted the common view that *Notostylops* belongs there. He held that the relationship to the Entelonychia was probably similar to that of *Metacheiromys* to the Loricata. In other words, as is clear from his other work and general usages, he believed that the arctostylopids were subordinally distinct but did not wish to make them so until better known. The view thus rather vaguely adumbrated is similar to that to which I have now come, quite independently and on the basis of a very large body of evidence not available to Matthew.

The Henricosborniidae (with the Pantostylopidae, etc.) have hitherto been studied only by Ameghino (see final conclusions in 1906), who places some of them in the "Prosimiae" as primates and some in Condylarthra. When they mention them at all, other writers have rejected these views, on general principles, and without restudy have placed this group in various notoungulate suborders. Thus both Scott (1913) and Schlosser (1923) placed some or all of them in the Typotheria probably because of a quite natural confusion with the Notopithecidae, which are typotheres but are quite distinct from the henricosborniids. It now appears probable that these very primitive forms, while they might be structurally ancestral to any of the three previously recognized suborders, are not definitely referable to any one of them. They do seem to be fairly close to the notostylopids and placing them in this new suborder, Notioprogonia, is a simple solution of the taxonomic and phylogenetic difficulties as now visualized.

The group Entelonychia was founded by Ameghino on the basis of the Homalodotheriidae, and especially of *Homalodotherium* itself, and defined on foot characters. He always considered the homalodotheres as related to chalicotheres (another case of convergence mistaken for affinity) and finally (e.g., 1906) he abandoned the name of Entelony-



chia and placed the Homalodotheriidae in the Ancylopoda. The other groups considered entelonychian by other authors were distributed in various orders. Although abandoned by its author, the name Entelonychia has been revived or continued in use by others and is now a generally accepted and quite necessary name in the taxonomy of notoungulates.

From this history it is clear that the name Entelonychia is principally based on *Homalodotherium* and is properly applicable only to include relatives of that genus. The propriety of placing *Notostylops*, *Henricosbornia*, *Palaeostylops*, etc., in the Entelonychia depends on the degree of their relationship to *Homalodotherium*, also taking into account, of course, the earlier forms ancestral or clearly allied to that genus. The reference of these groups to the Entelonychia depends on the statement or clear implication that they are more nearly related to the homalodotheres than to any typotheres or toxodonts. Although this is the common, almost traditional, expression, the actual evidence does not warrant such unanimity.

If a group Entelonychia is to be defined so as to include the Notostylopidae and still more primitive families, it must be based on the following characters, which are about the only important ones shared by homalodotheres and notostylopids:

1. Dentition brachyodont, rooted.
2. Cement absent.
3. Molars broader than long.
4. Premolars less complex than molars.
5. Auditory region of generalized notoungulate type, epitympanic sinus and related occipital exposure of pars serialis relatively small, porus rather low.
6. Skull orthocephalic, with long basicranial region.

Every one of these characters and apparently all the features that could be included in such a diagnosis are primitive and not really distinctive. They exclude the more specialized, later toxodonts and typotheres, but do not exclude the earlier members of those groups. All these characters do occur in the Toxodonta and Typotheria and are either known or with high probability inferred to have been universal in their early forms.

Even though *Notostylops*, *Henricosbornia*, *Palaeostylops*, and related genera resemble the homalodotheres only to the extent that both retain some primitive characters, some degree of special affinity might be suggested if the forms mentioned retained these characters after they had disappeared in the other suborders, but this is not the case. So far

as they are known, contemporaneous or even some later typotheres and toxodonts are not significantly more advanced in these respects than are the forms here placed in the Notioprogonia.

The homalodotheres are distinguished to a degree usually and reasonably considered subordinal, by the retention of certain primitive characters, such as the complete brachyodont dentition and pentadactyl feet, accompanied by the development of certain remarkable specializations not closely paralleled in other notoungulates, progressive or variable in the group, such as the canine tusks, retracted nasals, and extraordinary skeletal developments. The notioprogonians have been placed with this group largely because comparison was made mainly or only with much later forms, and was confined to a few primitive characters which were normal if not universal in the notoungulates of Casamayor age but were later lost except in the homalodotheres.

The notostylopids had, in fact, already lost some of the primitive characters, such as the closed tooth series, still present in the much later *Homalodotherium* and they did not have any of the peculiar specializations of the homalodotheres, early or late. The dentition gives no evidence of affinity beyond the fact that all are notoungulates. The general adaptive type and trend are different. The molar pattern also is distinctive. There is, for instance, more resemblance between the earliest typotheres and entelonychian molars than between either and *Notostylops*. The skulls are similar in so far as both are primitive. That of *Notostylops* seems to be very generalized, but it has some specialization, and this is not at all in the direction of the homalodotheres. As pointed out elsewhere (Simpson, 1933B), the braincasts, even in forms in comparable stages of development, indicate different lines of descent, and indeed tend to bring *Notostylops* closer to the typotheres than to the homalodotheres. The evidence of the skeletal parts, so far as the imperfect data go, is similar.

The almost inevitable conclusion is that the notostylopids are an early offshoot of the Notoungulata which shows no evidence of closer affinities to the Entelonychia (*sensu stricto*) than to other groups of notoungulates. They are a side branch, appearing as a minor and less distinctive group chiefly because of their early extinction and lack of more highly specialized Miocene or later descendants.

The general problem involves also the other early forms, less well known than *Notostylops*, which are also primitive and related in a general way to the various suborders of more long-lived and specialized notoungulates but not to any particular one of these suborders.

The broad nature of the phylogenetic relations indicated is, of course, subject to much possible modification from further discovery but as a theory on present evidence this is well founded and fairly clear and comprehensible. Its formulation and necessary taxonomic expression, however, are a difficult problem.

This problem is not unique and similar situations frequently arise in dealing with early mammals of any group or region. There seem to be three general types of solutions, none thoroughly satisfactory except as a working compromise, but each supported by good precedent and authority:

1. The later taxonomic group (suborder in this case) that is, on the whole, the most conservative might be broadened to include the ancestry of the whole larger unit (Order Notoungulata) and its early lines (such as the Notostylopidae, Henricosborniidae, etc.) regardless of whether the latter have any special affinity with the later members of this particular taxonomic group (suborder).

2. Each of these early lines, if it cannot be shown to be more closely related to one of the later groups than to another, or if it can be shown not to be, might be given a separate taxonomic position (necessarily subordinal in this case). Strict "vertical" or so-called phyletic classification demands this procedure and admits no alternative.

3. The undifferentiated ancestry of the whole larger unit (Notoungulata) and its relatively little modified early and sterile offshoots (including the Notostylopidae) might be placed in a unit (suborder) separate from the more long-lived and, eventually, more strongly modified and distinctive lines.

As a more or less analogous example of the first solution, may be cited the use of Insectivora to cover not only the relatively specialized recent representatives of that order but also many primitive and early mammals which have little or nothing in common with the modern insectivores except characters primitive for most or all placentals. In recent classifications there seems to be a drift away from this method and some tendency to place these early forms in distinct orders as they become better known, but this practice still holds to a certain extent.

Somewhat analogous examples of the second method are numerous. On a smaller scale, the separation of the hyracodonts from the true rhinoceroses as a non-ancestral group (family) of equal rank is an example. Because of the stressing of the more phyletic ideal in taxonomy and also, perhaps, because of some tendency to split hairs in such phyletic research, this has become probably the commonest course to follow in such cases.

A very closely analogous example of the third type of solution is the currently accepted classification of the Order Carnivora, the Suborder Creodonta including the ancestors of all later carnivores and also various highly distinctive but relatively short-lived early side branches, such as the hyaenodonts or mesonychids.

Of these practices, the last seems to me applicable to the present case with greatest convenience and least confusion. If, as has usually been done in the immediate past, the name Entelonychia be extended to include these early side branches, much confusion must result, as already suggested in part. The later and typical Entelonychia are not really generalized but in most respects very highly specialized. Whether they retain more primitive characters than contemporaneous members of other suborders, as has been implied, is really very debatable. Study of the recently discovered skeleton of *Homalodotherium* (Scott 1930), for instance, certainly will lead to great hesitance in accepting this view. From the Casamayor to post-Santa Cruz, the Entelonychia in a limited sense are a varied but quite distinct group. To include *Henricosbornia*, *Notostylops*, etc., in that group is in itself highly anomalous, and if the present views as to the real affinities of these genera are accepted, this would necessarily lead to the further anomaly of making the Entelonychia ancestral to all other notoungulates—an arrangement hardly less peculiar and unsatisfactory than would be the inclusion of the ancestral perissodactyls in the Chalicotherioidea, for instance.

The Suborder Notioprogonia is, therefore, named and defined to solve the present problem. The creation of this fourth suborder makes the differentiation of the other three much easier and renders it possible to make an arrangement of all the adequately known notoungulates which is relatively free of anomalies and confusion. The suborder is largely, but not exclusively, defined on primitive and negative characters. This does not necessarily make the group less distinctive, even verbally, since it includes no strongly aberrant forms which need to be considered as exceptional within it and since the other groups include no adequately known forms which are readily confused with notioprogonians. Like any taxonomic division the character of which is in part "horizontal," this suborder may prove to be unnatural to the extent of including phyla which may later prove to be more decisively separable, but as a whole it does now appear to be a natural unit and, furthermore, to be justified if on no other basis than that of convenience in dealing with various waifs and strays in the most practical and least misleading way.

The relationships of the Notioprogonia to the other notoungulates are probably similar to those of the creodonts to the other carnivores.

As a composite, or as an abstraction of the characters common to its various numbers, it probably nearly represents the structural ancestry of the other notoungulates, and if that actual common ancestry were found it would probably be notioprogonian by definition. There are also included various ancient and relatively archaic side lines that did not survive long enough to have major and separate deployments.

#### ENTELONYCHIA

This group was founded by Ameghino on the basis of the Homalodotheriidae and especially of *Homalodotherium*.<sup>1</sup> Ameghino later abandoned the name Entelonychia and referred these animals to the Ancylopoda (=Chalicotherioidea). Most other authors, however, probably impressed by the comparative conservatism in the dentition of *Homalodotherium*, retained the name Entelonychia and extended it to include a number of primitive forms with other notoungulates. This has been discussed under "Notioprogonia." On the evidence at hand, I confine the name Entelonychia to the Homalodotheriidae and the closely related, perhaps synonymous, Isotemnidae.

#### TOXODONTA

Toxodontia was proposed by Owen for an order or suborder of ungulates, with *Toxodon* and *Nesodon* given as examples of the group. With subsequent discovery, the marked differences between these animals and some others, especially the typotheres, were not recognized, or were less emphasized than the resemblances. Thus, for instance, Lydekker (1894) includes the typotheres in the Suborder Toxodontia, although Zittel in the same year placed them apart in the Typotheria and confined Toxodontia to the true toxodonts plus the astrapotheres and homalodotheres (both placed in the Astrapotheria by Lydekker). Ameghino at first also included both toxodonts and typotheres in the Toxodontia, but he later separated them, using the names Typotheria and Toxodontia (the only names of more than family rank in his definitive classification which are exclusively applied to South American groups). Gregory (1910) returned to Lydekker's system of placing both toxodonts and typotheres in one group, but almost all other recent authors have recognized them as forming two distinctive units of equal rank. Scott's proposal to use the form Toxodonta for the toxodonts

<sup>1</sup>Many authors (particularly Scott and later workers) have used the emendation *Homalodonto-*  
*therium*. It is true that *Homalodotherium* Huxley, 1870, is a *nomen nudum* with no standing in nomen-  
clature and that Flower in his definitive description of 1874 used the spelling *Homalodonto-*  
*therium*, but Flower published a brief, valid description in 1873 under the name *Homalodotherium*. The genus is  
therefore *Homalodotherium* Flower, 1873. I am indebted to Patterson for calling my attention to this  
history.

proper and giving the name *Toxodontia* to a group of even wider scope than that of Lydekker and of Gregory has already been mentioned, and the reasons for rejecting it given.

In order to avoid confusion with Scott's variant usages, I tentatively retain his spelling *Toxodonta* for this group (suborder in this system). No one now denies its general character and distinction. One dubious point is the reference here of the *Leontiniidae*, in which I follow Scott although further study of this point seems essential. It is curious that no representative of this very important suborder has yet been surely recognized previous to the *Deseado*. The *Archaeohyracidae* were tentatively placed here by Gregory, and this may be correct although pending more detailed study it seems more probable that this family belongs in the *Typotheria*. There is also the family *Acoelodidae* which might be of toxodont affinities, but is also tentatively placed in the *Typotheria* pending further study. These forms are so near the point of divergence of typotheres, toxodonts, and homalodotheres that their subordinal position is still difficult to define.

I follow Scott in uniting the *Nesodontidae* and *Toxodontidae*, which are closely related and perhaps only progressive stages of the same rather limited group, and Patterson (personal communication, paper in press) in uniting the *Rhynchippidae* and *Notohippidae*.

#### TYPOTHERIA

Previous to 1893, the typotheres and toxodonts were confused and were commonly united in the *Toxodontia*, but in that year Zittel established the ungulate Suborder *Typotheria* with the families *Protypotheriidae* (= *Interatheriidae*) and *Typotheriidae*. The addition of the family *Hegetotheriidae* by Ameghino brought the suborder into essentially its present form, and there is little question as to its validity and general character. The *Casamayor* and *Musters* *Notopithecidae* are certainly typotheres, and perhaps could be united with the *Interatheriidae*, which they closely resemble in skull structure although the dentition is much more primitive. *Archaeohyracidae* and *Acoelodidae* are placed here only tentatively, pending more detailed study. One or both might prove to be toxodonts.

#### ASTRAPOTHERIA

This name was proposed by Lydekker (1894) for a suborder of the Order *Ungulata*, to include the *Astrapotheriidae* and *Homalodotheriidae*. In the same year, however, Ameghino placed the homalodotheres in the distinct group *Entelonychia*, and almost all later workers have followed

this step of Ameghino's.<sup>1</sup> In 1894 Ameghino placed the astrapotheres in a suborder Astrapotherioidea. In his definitive work, Ameghino referred the astrapotheres to the Amblypoda, but this has been thoroughly controverted (see especially Scott, 1932 and earlier papers) and requires no further comment. The present questions are (1) the degree of relationship between the astrapotheres and the typical notoungulates, and (2) the placing of the family Trigonostylopidae.

Both of these questions have been considered in a preliminary paper of this series (Simpson 1933A). On the data there given, and other facts to be more fully discussed elsewhere, it is concluded (1) that the astrapotheres are not closely related to the typical Notoungulata and probably should not be included in that order, (2) that litopterns, astrapotheres, and trigonostylopids probably had a common, possibly condylarth, ancestry, (3) that these three groups represent three distinct and divergent lines from that ancestry, and (4) that the trigonostylopids may be nearer to the astrapother line than to the litoptern line, or possibly diverged from the ancestral astrapotheres after their origin as such, but are nevertheless very distinctive from any true astrapotheres.

The taxonomic expression of these views seems most simply accomplished by retaining a separate Order Astrapotheria, reviving Ameghino's Suborder Astrapotherioidea for the true or typical astrapotheres, and placing the Trigonostylopidae in a second suborder, Trigonostylopoidea, defined below.

#### ASTRAPOTHERIOIDEA

This suborder is redefined as follows:

Extinct South American ungulates, typical of the Order Astrapotheria. Three pairs of strongly bilobed lower incisors. Upper incisors lost, at least in later genera. Canines very large and becoming rootless tusks. Premolars becoming reduced to  $\frac{2}{3}$ . Cheek teeth becoming moderately hypsodont, always rooted. Upper molars trapezoidal, without distinct metacone fold, protoloph strong, hypocone not excluded from trigon and tending to merge into a metaloph, crista incipient to strong. Lower molars fully lophodont and bicrescentic, anterior wing of trigonid crescent strong, secondary internal pillar arising at anterior end of talonid crescent. Infraorbital foramen single. Palate and choanae normal. Sagittal crest short, temporal crests very strong. Auditory region deeply embedded and exposure small, auditory notch deep and narrow, tympanic loosely attached, post-tympanic process strong, no occipital exposure of mastoid. Condylar foramen large and independent. Skeleton (unknown in Trigonostylopoidea or earliest Astrapotherioidea) becoming graviportal, feet retaining five digits. Scaphoid resting on trapezium and trapezoid, not reaching magnum,

<sup>1</sup>Gregory (1910) did suggest that Lydekker had some basis for his grouping. Gregory's classification did not place the Homalodotheriidae in the Astrapotheria, but did so place the Isotemnidae, a family so near the Homalodotheriidae as to be possibly synonymous.

lunar overlapping uniform. No fibulo-calcaneal or naviculo-cuboid contacts. Astragalus short, broad, very short neck, cuboid facet rather on neck than on head. Proximal end of cuboid covered by astragalus, calcaneal facet on fibular side. Second and third digits of pes reduced, first and fourth large.

### Suborder **TRIGONOSTYLOPOIDEA**, new

DISTRIBUTION.—Casamayor and (?) Musters Formations, Patagonia.

DIAGNOSIS.—Extinct South American ungulates of very isolated and doubtful position, but perhaps related to the Astrapotheria. Two pairs of one-lobed lower incisors.  $P_1^+$  present (vestigial) or absent,  $P_2^2 = \frac{2}{1}$  present. Tusks somewhat like those of true astrapotheres, but always rooted, relatively low-crowned, and smaller. Cheek teeth brachyodont. Upper molars usually triangular, metacone fold present but may be very weak, protoloph continuous but feeble, hypocone rudimentary and excluded from trigon, no true metaloph, no crista, trigon basin closed, broad, shallow. Lower molars imperfectly lophodont, anterior wing of trigonid poorly developed and short, ending at midline, no talonid pillar. Infraorbital foramen multiple. Palate with posterior median process. Choanae divided by bony partition. Sagittal crest very long and powerful, temporal crests little developed. Auditory region broadly expanded and well exposed. Auditory notch broad and open, post-tympanic process practically absent. Tympanic nearly horizontal, attached suturally, thick and scale-like, not inflated, with deep notch beneath meatus and round carotid evagination on inner side. Mastoid exposed on occiput. Condylar foramen far from condyle and opening into pit or gap between tympanic and basioccipital.

### PYROTHERIA

This group was named by Ameghino in 1895, but as in many other cases he abandoned it under the growing influence of his belief in an Argentine origin for all mammalian orders, and in his definitive classification (1906) the word Pyrotheria does not appear and the pyrotheres are placed in the Proboscidea. Loomis (1914) agreed that they are proboscideans, but retained the Pyrotheria as a suborder. I believe no more recent authority definitely accepts this view of relationships (now abandoned even by Loomis) and the question now is whether the pyrotheres are related to the notoungulates.<sup>1</sup>

Scott at first (1904) excluded the pyrotheres from the Notoungulata (his Toxodontia) but later (1913) placed them there. Still more recently (1932) he seems to incline slightly, but not definitely, back to the idea of proboscidean relationships. Gaudry (1909) concluded that *Pyrotherium* is not clearly related to any known order. Gregory (1910) argues for a somewhat remote connection with the Entelonychia ("Homalodotheria"), and doubtfully includes the Suborder Pyrotheria in the Notoungulata.

<sup>1</sup>Schlosser (1923), places the pyrotheres in the Amblypoda. Perhaps a case could be made out for this, but Schlosser adduces no important evidence, nor am I acquainted with any.



Much new skeletal material has been collected by Riggs, and this will presumably give a better basis for judgment. My own restudy of the early dental remains, hardly considered by other students, and of the published data on *Pyrotherium* itself, strongly opposes union either with the Proboscidea or with the Notoungulata. The group seems to be a very distinctive one of unknown sub- or proto-ungulate origin, and can at present only be classified as an independent order. I see no good reason for placing the little known and probably merely ancestral early forms in a separate family, Carolozitteliidae, as did Ameghino, and place all pyrotheres in the Pyrotheriidae.

#### REFERENCES

References are only to papers explicitly cited in the text, not to all original publications of taxonomic groups or to the very large general literature of the subject.

- AMEGHINO, F. 1906. 'Les formations sédimentaires du crétacé supérieur et du tertiaire de la Patagonie.' An. Mus. Nac. Buenos Aires, XV [(3) VIII], pp. 1-568.
- GAUDRY, A. 1909. 'Fossiles de Patagonie: le *Pyrotherium*.' Ann. Paléont., VI, pp. 1-28.
- GREGORY, W. K. 1910. 'The orders of mammals.' Bull. Amer. Mus. Nat. Hist., XXVII, pp. 1-524.
- LOOMIS, F. B. 1914. 'The Deseado Formation of Patagonia.' Amherst College, Amherst.
- LYDEKKER, R. 1894. 'A study of the extinct ungulates of Argentina.' An. Mus. La Plata (for 1893), Pale. Arg., II, pp. 1-91.
- MATTHEW, W. D. 1915. 'A revision of the Lower Eocene Wasatch and Wind River faunas. Part IV.—Entelonychia, Primates, Insectivora (Part).' Bull. Amer. Mus. Nat. Hist., XXXIV, pp. 429-483.
- OSBORN, H. F. 1910. 'The Age of Mammals in Europe, Asia, and North America.' The Macmillan Co., New York.
- ROTH, S. 1903. 'Los ungulados sudamericanos.' An. Mus. La Plata, Sec. Pale., V, pp. 1-36.
- SCHLOSSER, M. 1923. 'Mammalia,' in K. A. v. Zittel, 'Grundzüge der Paläeontologie; II. Abteilung: Vertebrata.' 4th edition. R. Oldenburg, Munich and Berlin.
- SCOTT, W. B. 1904. 'The Miocene ungulates of Patagonia.' Rept. British Assoc. Adv. Sci., pp. 589-590.
1910. 'Litopterna of the Santa Cruz Beds.' Repts. Princeton Exped. Patagonia, VII, pp. 1-156.
1913. 'A history of land mammals in the Western Hemisphere.' The Macmillan Co., New York.
1930. 'A partial skeleton of *Homalodontotherium* from the Santa Cruz Beds of Patagonia.' Field Mus. Nat. Hist., Geol. Mem., I, pp. 7-34.

1932. 'Nature and origin of the Santa Cruz fauna.' Repts. Princeton  
Exped. Patagonia, VII, pp. 193-238.
- SIMPSON, G. G. 1933A. 'Structure and affinities of *Trigonostylops*.' Amer. Mus.  
Novitates, No. 608.
- 1933B. 'Braincasts of two typotheres and a litoptern.' Amer. Mus.  
Novitates, No. 629.



59.57.72 T (8)

## AFRICAN TACHINIDAE—I

BY C. H. CURRAN

In this contribution will be found descriptions of a number of new species of African Tachinidae with notes on some previously described species. Much of the material has been furnished by the Imperial Bureau of Entomology, Mr. H. K. Munro, and Mr. Alexander Cuthbertson, to whom I wish to express my appreciation.

Unless otherwise stated, the types of new species are in The American Museum of Natural History.

### STURMIA Desvoidy

The four species described below should possibly be placed in a genus other than *Sturmia* although possessing most of the characters of this genus but, since there is great need of a revision of the African species of Tachinidae and insufficient is known concerning the species and genera, I prefer to describe the species in this genus. All the species are small, with flattened abdomen, black-haired occiput and the antennae situated slightly lower on the head than is usual in *Sturmia*, and in addition all have fine bristles on the lowest third of the parafacials and the basal two abdominal segments shining black. The number of bristles on the base of the third vein varies from one to two, sometimes differing in the wings of the same individual.

There are at least six species belonging to this group, but as two of them are represented by single specimens, descriptions are not given at the present time. Those described are separable as follows.

- 1.—Apical two abdominal segments almost wholly golden-yellow pollinose.  
*auratocauda*, n. sp.
- Apical segments with white or pale yellow pollen. . . . . 2.
- 2.—Apical segments chalky white pollinose with the apices black. . . . . *albocauda*, n. sp.
- Apical segments with the apical third or more black. . . . . 3.
- 3.—Middle tibiae with an anteroventral or ventral bristle beyond the middle; pale pollinose abdominal fasciae but little narrowed toward the sides.  
*versicauda*, n. sp.
- Middle tibiae without such bristle; pale pollinose fasciae wider and strongly narrowed to the sides. . . . . *fascicauda*, n. sp.

***Sturmia auratocauda*, new species**

Shining black, the apical two abdominal segments golden-yellow pollinose; male with rectangular sexual patch on under side of third abdominal segment. Length, 5 to 7 mm.

**MALE.**—Head black in ground color, white pollinose, the parafrontals almost bare on the upper half, the occiput shining except immediately behind the eyes. Front half as wide as either eye at widest part, with almost parallel sides on the upper third; about eleven pairs of frontal bristles, the upper two pairs strong and reclinate; parafrontals a little narrower than the frontal vitta, with moderately long hair; ocellars fairly long. Occipital hair wholly black. Cheeks one-seventh as wide as the eye-height, with black hair. Parafacials strongly narrowing below, bare below the frontals. Vibrissae situated level with the oral margin, the facial ridges with short bristly hairs on almost the lower half. Palpi black, bearing short hairs. Antennae black or brown, extending to the lowest fifth of the face; third segment about three times as long as the second, narrow, the apex rounded; arista pubescent.

Thorax shining black, the pleura with some very thin brownish pollen. Acrosticals, 3-3; dorsocentrals, 3-4; sternopleurals, 1-1, or with a third weak one near the anterior, in which case they form an almost straight line. Scutellum with four or five pairs of marginals, the apical pair decussate, and one pair of discals. Prosternum with hairs and a pair of weak bristles.

Legs black; middle tibiae with a single anterior bristle, situated near the middle; posterior tibiae almost evenly but not closely ciliate; pulvilli luteous, longer than the fifth tarsal segment.

Wings cinereous hyaline, the base brown; apical cell very narrowly open considerably before the wing-tip; third vein normally with a single basal bristle, rarely with two weak ones, more often with one bristle and a very short hair. Squamae brownish. Halteres reddish brown.

Abdomen shining black, the third and fourth segments densely golden-yellow pollinose dorsally, each with the apical sixth or less shining black, the sides of the third and fourth segments more or less broadly dull reddish. On the under side the abdomen is more extensively reddish and almost wholly without pale pollen, the third segment with a rather large, transverse, rectangular sexual patch of appressed, short hair. First segment without median marginals, the second with a very weak pair, the third and fourth each with a row, the fourth also with a row of discals. The hair is appressed except on the middle of the second segment, where it is suberect, longer and more abundant.

**FEMALE.**—Front half as wide as either eye, gently widening from the vertex to the antennae; eight or nine pairs of frontals and two pairs of proclinate orbitals, the hair shorter and rather sparse. Outer verticals absent. Palpi rather strongly swollen. Second abdominal segment with a row of appressed or subappressed marginals, the third and fourth wholly golden-yellow pollinose except the sides of the posterior border.

**TYPES.**—Holotype, male, Ibadan, Nigeria, June 30, 1922 (Dr. W. J. Pomeroy). Allotype, female, Nigeria, 1924 (O. B. Lean). Paratypes: male and three females, Ibadan, September 29, October 5, 22, and 25, 1920; two females, Ibadan, August 17, 1913, and November 29, 1913 (Dr. W. A. Lamborn); three females, Ibadan, 1934 (O. B. Lean); male and two females, Kpeve, Gold Coast, November, 1927, 1931, and

December 21, 1931 (G. S. Cotterell); and female, Aburi, Gold Coast, May 1, 1927 (G. S. Cotterell), ex cotton leaf-roller, *Anoma* species. Almost all the specimens are labelled "from cotton" and it is probable that they were reared from the same host, although one was reared from *Sylepta derogata*. Types in British Museum of Natural History.

***Sturmia albicauda*, new species**

Shining black, the third and fourth abdominal segments thickly white pollinose. Length, 6 mm.

MALE.—Head black in ground color, with white pollen, the parafrontals cinereous-white pollinose below, becoming bare above; occiput shining black, the posterior orbits silvery white on the lower half. Front a little less than half as wide as either eye; ten or eleven pairs of frontals, the upper two pairs strong and reclinate; hair short and fairly abundant; ocellars long. Outer verticals absent; hair of the occiput and cheeks wholly black. Cheeks shining, slightly more than one-sixth as wide as the eye-height. Parafacials strongly narrowing below; vibrissae situated level with the oral margin; facial ridges with weak bristles on the lowest third. Palpi black. Antennae brown, the third segment about two and one-half times as long as the second, the apex rounded; arista thickened and microscopically pubescent on the basal fourth.

Thorax shining black, the pleura with thin brownish pollen. Acrosticals, 3-3; dorsocentrals, 3-4; sternopleurals, 2-1, the lower weak. Scutellum with four pairs of marginals, the apical pair weak and decussate, and one pair of discals. Prosternum with lateral hairs.

Legs black; middle tibiae without an anterior bristle; posterior tibiae almost evenly and rather sparsely ciliate; pulvilli long.

Wings cinereous hyaline, the base darkened; apical cell narrowly open moderately before the wing-tip; third vein with a single basal bristle. Squamae light brown. Halteres reddish brown.

Abdomen with the basal two segments shining black, the apical two densely white pollinose with the apical fifth of each shining. Second segment with a pair of weak marginals, the third and fourth each with a row, the fourth with two rows of fine discals; hair appressed; more abundant, longer and erect on the middle of the second segment. Under surface wholly shining black, the third segment with a large, subrectangular sexual patch of appressed hair on either side.

TYPE.—Male, on board ship off Loango, French Congo, November 30, 1926 (J. Bequaert).

***Sturmia fascicauda*, new species**

Shining black, the third and fourth abdominal segments white pollinose on more than the basal half. Length, 6 to 6.5 mm.

MALE.—Head black in ground color, the face and lower half of the posterior orbits white pollinose, the parafrontals thinly cinereous-white pollinose on about the lower half. Front half as wide as either eye; twelve pairs of frontals, the upper two pairs strong and reclinate; hair moderately long and fairly abundant; ocellars long. Outer verticals absent; occiput and cheeks black-haired. Cheeks one-seventh as wide as eye-height. Parafacials strongly narrowing below; vibrissae situated level with the oral margin, the facial ridges with weak bristles on the lowest third. Palpi

black. Antennae long and rather narrow, the third segment two and one-half times as long as the second and with rounded apex; arista tapering from near the base, short pubescent on the basal third.

Thorax shining black, the pleura with brownish pollen. Acrosticals, 3-3; dorso-centrals, 3-4; sternopleurals, 1-1-1, the second weak and situated close to the first. Four pairs of marginal scutellars, the apical pair weak and decussate. Prosternum with bristly hairs on the sides.

Legs black; middle tibiae with a strong anterior bristle situated beyond the middle; posterior tibiae evenly but not densely ciliate, with a longer bristle in the row; pulvilli yellowish and elongate.

Wings cinereous hyaline, the base brown, the costal border with brownish tinge on the basal half; apical cell narrowly open moderately before the wing-tip; third vein with one or two weak basal bristles. Squamae brown. Halteres yellow, with brown knob.

Abdomen shining black, the apical segments with white pollen. Second segment with a pair of rather short median marginals, the third and fourth each with a row, the fourth with a row of discals. Hair appressed, longer and a little more erect on the middle of the second segment. Pale pollen extending to the apical third of the segments, gradually narrowing to the sides. Under surface wholly shining, the third segment with a large, rectangular sexual patch on either side.

Types.—Holotype, male, and paratype, male, East London, South Africa, January 11, 1925, and February 27, 1925 (H. K. Munro), the type returned to Mr. Munro.

### ***Sturmia versicauda*, new species**

Shining black, the apical two abdominal segments with white pollen on the basal half or less. Length, 5 to 7 mm.

MALE.—Head black in ground color, the face and lower half of the occiput white pollinose; parafrontals less thickly white pollinose on the anterior two-thirds. Front half as wide as either eye; ten or eleven pairs of frontals, the upper two pairs strong and reclinate; hair rather long but not abundant; ocellars long. Outer verticals absent; hair of occiput and cheeks black. Cheeks thinly white pollinose, almost one-fifth as wide as the eye-height. Parafacials strongly narrowing below. Vibrissae situated level with the oral margin, the facial ridges with weak bristles on the lowest third. Palpi black. Antennae brown, moderately long, the third segment twice as long as the second and wider than in related forms; arista thickened on the basal fifth, pubescent on the basal third.

Thorax shining black, the pleura with thin brown pollen. Acrosticals, 3-3; dorso-centrals, 3-4; three sternopleurals, the second weak and usually situated below a line drawn between the other two. Scutellum with four pairs of marginals, the apical pair weak and decussate, and a pair of discals. Prosternum with a bristle and several lateral hairs.

Legs black; middle tibiae with a strong anterior bristle situated beyond the middle and an anteroventral bristle somewhat beyond it; posterior tibiae evenly and fairly closely ciliate; pulvilli yellow and moderately long.

Wings cinereous hyaline, the base blackish brown. Apical cell narrowly open moderately before the apex of the wing; third vein with one or two basal bristles. Squamae pale yellowish brown or brownish yellow. Halteres yellow, with brown knob.

Abdomen shining black, the basal half or less of the third and fourth segments white pollinose, the bands not or but little narrowing laterally. Second segment with a pair of short median marginals, the third and fourth each with a row, the fourth also with a row or two of weaker discals. Hair appressed, but more erect and longer on the middle of the second and third segments. Ventral surface wholly shining black, the sides of the third segment with a large, subrectangular sex-patch of appressed brownish hair.

**FEMALE.**—Front about seven-eighths as wide as either eye; hair short; two pairs of strong, proclinate orbital bristles; outer verticals absent; palpi somewhat swollen. Squamae white, with yellow rim. Abdomen without erect hair on median segments, the pollinose fascia on the third segment a little narrower, that on the fourth somewhat wider.

**TYPES.**—Holotype, male, allotype, female, Wernen, Natal, November, 1923. Paratypes: two males and two females, Wernen, November, 1922, August–September 1923, and November, 1923 (H. P. Thomasset); male and female, Nazi Moja, Zanzibar, October–December, 1924 (H. J. Snell). The holotype and allotype are in the British Museum of Natural History.

This species rather closely resembles *fascicauda* but, in addition to having narrower and more uniformly wide pale pollinose abdominal fasciae, it has a ventral or anteroventral bristle on the median tibia, wider cheeks, etc.

#### **LINNAEMYA** Desvoidy

*Linnaemya* DESVOIDY, 1830, Mem. Acad. Roy. Sci. Inst., France, II, p. 52.

*Bonnetia* DESVOIDY, 1830, idem, p. 55.

*Bonellia* DESVOIDY, 1830, idem, p. 56.

*Marshamia* DESVOIDY, 1830, idem, p. 57.

*Micropalpus* MACQUART, 1834, 'Hist. Nat. Dipt.,' p. 316.

*Amphisia* DESVOIDY, 1863, 'Posth.,' I, p. 129 (not Curtis, 1828).

*Homoeonychia* BRAUER AND BERGENSTAMM, 1889, Denksch. Akad. Wien, LVI, p. 133.

*Tachinomima* BRAUER AND BERGENSTAMM, 1891, Denkschr. Akad. Wien, I.VIII, p. 383.

*Hecatoepalpus* TOWNSEND, 1932, Jour. N. Y. Ent. Soc., XL, p. 467.

In the strict sense the species of *Linnaemya* possess two pairs of orbital bristles, whereas *Bonnetia* (*Micropalpus*) lacks them. This is a sexual character and there is no means of distinguishing the females. Both the character of the hair on the cheeks and the presence of infra-squamal setules are of no value as the nature of the former varies, the fine hair merging to coarse and the infra-squamal setules may be absent, one or two present, or they may be numerous. The proboscis varies in length in the different species, having its greatest length in *expetans* Brauer and Bergenstamm, being twice as long as the head-height, whereas in most species it is shorter than the head-height, but always elongate and with rather small labellae. The palpi vary in length from



very short to six times as long as wide but the character is not reliable. Eight of the African species have the pteropleural bristle extending only to about the apical fourth of the squamae whereas the remainder have it extending to the apex, but the character does not appear to be reliable in this case as there is variation in the length, some of the species coming rather close to the alternate group. The length of the claws and pulvilli is also variable.

As here interpreted *Linnaemya* includes a large number of species showing diversity in many ways but all agreeing in having pilose eyes, distinct ocellar bristles, moderately wide cheeks, projecting oral margin and long antennae, the third segment varying in width. There are usually three pairs of postsutural dorsocentrals, but a few of the species have four. The legs are usually reddish, black in a few cases, the tarsi varying from red to black. Wings variable in color, hyaline, brown, gray or variegated; third vein with several basal bristles. Abdomen oval or elongate oval, with or without discal bristles on the intermediate segments, rarely with some short, aculeate spines. The posterior forceps of the male genitalia are fused and, along with the outer forceps, vary in width and shape.

As a result of the present studies, most of the species are described as new, as it has not been possible to identify, from the descriptions, several of those previously described. The best means of separating the species is by a study of the male genitalia. It will be found that forms resembling each other rather closely have different genitalia and that other and more accessible characters parallel the genitalic differences, so that it is possible to associate the sexes.

#### TABLE OF SPECIES

- |  |     |
|--|-----|
| 1.—Femora black.....   | 2.  |
| Femora reddish, often darkened at the apex, rarely blackish on the upper surface.....                                      |     |
| 2.—Pleura with yellow pile; large species.....   | 3.  |
| Pleura wholly black-haired; abdomen with median black vitta or mostly black.<br><i>agilis</i> , n. sp.                     |     |
| 3.—Posterior femora broadly black or brown on whole length above; pleura black-haired; cheeks with sparse black hairs..... | 4.  |
| Femora never blackish on whole upper surface.....  |     |
| 4.—Second abdominal segment with at least one pair of discal bristles.....   | 11. |
| Second abdominal segment without discals, the third sometimes with a pair.....   |     |
| 5.—Wings brownish on the apical half, yellowish basally except behind.....   | 10. |
| Wings almost unicolorous or brownish on the whole length.....  |     |
| 6.—Epaulet yellowish.....  | 9.  |
| Epaulet brown or brownish red.....   |     |
|  | 7.  |

- 7.—Mesonotum almost wholly black-haired. . . . . 8.  
 Mesonotum wholly pale-haired. . . . . *neavei*, n. sp.
- 8.—Ventral part of the second tergite practically all black-haired.  
*parcesetosa* Villeneuve.  
 Ventral part of second tergite almost all yellow pilose. . . . . *luckmani*, n. sp.
- 9.—Palpi not more than three times as long as broad; third antennal segment of male strongly produced near the base. . . . . *angulicornis* Speiser.  
 Palpi as long as thickness of proboscis; third antennal segment of male very broad, not produced. . . . . *alboscuteolata* Speiser.
- 10.—Mesonotal hair practically all fine and yellow. . . . . *nyasa*, n. sp.  
 Mesonotal hair black, only a few pale hairs laterally. . . . . *lamborni*, n. sp.
- 11.—Mesopleura mostly clothed with yellow pile, usually some coarse black hairs above. . . . . 20.  
 Mesopleura with black hair on the whole surface. . . . . 12.
- 12.—Second abdominal segment with two rows of spines in the middle.  
*aculeatus* Villeneuve.  
 Second segment with one pair of discal bristles. . . . . 13.
- 13.—Epaulet mostly brown; wings cinereous; four pairs of postsutural dorsocentrals.  
*pilitoris* Villeneuve.  
 Epaulet reddish or yellowish, if rather dark the wings are brownish; three or four pairs of postsutural dorsocentrals. . . . . 14.
- 14.—Palpi less than three times as long as wide. . . . . 16.  
 Palpi at least five times as long as wide. . . . . 15.
- 15.—Fourth abdominal segment wholly without pollen. . . . . *ethelia*, n. sp.  
 Fourth abdominal segment strongly pollinose laterally. . . . . *pictipennis* Curran.
- 16.—Front coxae broadly black along the inner edge. . . . . *conformis* Curran.  
 Front coxae wholly reddish or yellowish. . . . . 17.
- 17.—Under surface of the abdomen entirely black-haired. . . . . 19.  
 Under surface of the abdomen with yellow pile on the under side of the first segment and on the basal sternites. . . . . 18.
- 18.—Cheeks yellow-haired, one or two black hairs present; second antennal segment reddish yellow. . . . . *gowdeyi*, n. sp.  
 Cheeks with black hair; basal antennal segments blackish. . . . . *victoria*, n. sp.
- 19.—Pteropleural bristle extending to the apex of the squamae; posterior genital forceps of male transversely concave near the middle. . . . . *shillitoi*, n. sp.  
 Pteropleural much shorter; posterior forceps flat. . . . . *loreensis*, n. sp.
- 20.—Abdomen clothed with reddish-yellow hair; second abdominal segment with at least two pairs of discals. . . . . *bequaerti*, n. sp.  
 Abdomen with black hair dorsally. . . . . 21.
- 21.—Trochanters black. . . . . 22.  
 Trochanters yellow. . . . . 24.
- 22.—Epaulet brown. . . . . 23.  
 Epaulet yellow. . . . . *aptus*, n. sp.
- 23.—Cheeks with two or more black bristles anteriorly. . . . . *affinis* Corti.  
 Cheeks bearing only fine, yellow pile. . . . . *vulpinus* Fallén.
- 24.—Palpi not three times as long as wide. . . . . 25.  
 Palpi five or six times as long as wide; wings strongly bicolored.  
*turbida* Brauer and Bergenstamm.

- 25.—Epaulet red. . . . . 26.  
    Epaulet brown. . . . . species.
- 26.—Second abdominal segment with short spines between the discals and marginals. . . . .  
   *cuthbertsoni*, n. sp.
- Second segment with one pair of discals. . . . . 27.
- 27.—Proboscis much longer than the head-height. . . . . *longirostris* Macquart.  
    Proboscis not quite as long as the head-height. . . . . 28.
- 28.—Mesonotum clothed with yellow hair . . . . . *ingrami*, n. sp.  
    Mesonotum almost all black-haired. . . . . *andersoni*, n. sp.

*Tachinomima laxiceps* VILLNEUEVE, 1916, Ann. S. Afr. Mus., XV, p. 473.

Female, Pretoria, South Africa, February 28, 1915 (H. K. Munro), and female, Nkandhla Forest, S. Africa, January 22, 1916 (Janse).

This species is easily recognized by the black femora and yellow pilose pleura. The palpi are only a little longer than wide and bear a short, yellow apical bristle. Length, 12 to 13 mm.

A small species having black legs, black-haired pleura and whitish yellow scutellum. Length, 7 to 9.5 mm.

MALE.—Face and cheeks yellow, the front and occiput black in ground color, rather thickly white pollinose. Front scarcely half as wide as either eye; nine pairs of frontals, the upper one or two pairs reclinate but not strengthened; ocellars moderately long and fine; parafrontals with short, fine black hair. Occiput white pilose, the black occipital cilia extending to the cheeks, the row doubled or trebled below. Cheeks slightly more than one-third as wide as the eye-height, with sparse, long black hair. Parafacials without hairs below the frontals. Proboscis only projecting slightly beyond the oral margin, the brown palpi five or six times as long as wide. Antennae brown, the third segment not widened, obtusely rounded at the apex; arista brown, the penultimate segment almost three times as long as wide.

Thorax black, cinereous pollinose, the black mesonotal vittae moderately distinct in some views; humeri, posterior calli, and scutellum yellowish; hair wholly black. Scutellum with only one pair of discals, the hair not bristle-like.

Legs blackish, wholly black-haired, the tibiae more or less brownish red or luteous.

Wings cinereous hyaline, the veins yellow at the base. Alula and squamae white. Halteres yellow.

Abdomen shining black with the sides very broadly reddish yellow to beyond the middle; the broad apex of the fourth segment shining reddish; under surface mostly yellowish. Hair wholly black, rather coarse and erect on the middle of the second segment, dense, subappressed and parted in the middle on the dorsum of the third and fourth segments; discal bristles entirely absent, the second and third segments each with a pair of marginals, the fourth with a row. Genitalia reddish, the posterior forceps brown. Lobes of the fifth sternite short, rather broadly produced on their inner apices.

**FEMALE.**—Front three-fifths as wide as either eye, the sides gradually widening, so that at the antennae it is one-fifth wider than eye; eight or nine pairs of frontals, the upper pair reclinate; two pairs of strong, proclinate orbitals; hair of cheeks coarse and sometimes one or two bristles present in front. Abdomen dark, blackish and reddish brown, tessellate with thin whitish pollen except the broad reddish apex of the fourth segment, the hair all appressed and not dense, the fourth segment with a row of discals.

**TYPES.**—Holotype, male, and allotype, female, Monogoro, Tanganyika, July, 1923 (A. H. Ritchie), ex *Chloridea obsoleta*, in British Museum of Natural History. Paratypes: female, Durban, Natal, July 31, 1916 (C. N. Barker); male, Durban, June 2, 1920; male, East London, Cape Province, May, 1924 (H. K. Munro); and male, Isopingo, South Africa, July 29, 1922.

### *Linnaemya strigipes*, new species

Trochanters black; at least posterior femora broadly black above; abdomen without discals on intermediate segments. Length, 11 to 12 mm.

**MALE.**—Front and most of the occiput black, the face, cheeks and lower part of the occiput yellow in ground color, thickly white pollinose. Front a little more than four-fifths as wide as either eye; about twelve pairs of frontals, the upper two pairs stronger and reclinate or partly so; ocellars long; frontal hair black, a row of coarse hairs near the frontals. Occiput white pilose; black occipital cilia extending to the cheeks, the row doubled below, several black setulae behind the upper occipital cilia. Cheeks almost half as wide as the eye-height, with sparse, mostly coarse black hairs. Proboscis a little shorter than the head-height; palpi not twice as long as wide, brown without apical bristle. Antennae brown, the incisures reddish; third segment moderately wide and only slightly widening to the obtuse apex; arista thick, short pubescent, the penultimate segment about three times as long as wide.

Thorax black, the humeri, sides of the mesonotum, scutellum and part of the pleura brownish yellow or luteous; pollen cinereous, on the posterior part of the mesonotum with brown tinge; hair wholly black. Scutellum with one pair of discals and some coarse, bristly hairs.

Legs reddish; coxae partly black; trochanters, a spot at the base of each femur, a broad stripe before their apex below and the broad upper surface of the posterior four, black or brown, the tarsi black.

Wings cinereous hyaline, the veins mostly luteous; epaulet brown. Squamae white. Halteres yellow.

Abdomen rusty reddish, with tessellate, yellowish-tinged pollen except on the apices of the segments, with a rather narrow, median black vitta which expands on the fourth segment but reaches only to the apical third. Hair wholly black, appressed, basal segments without discals, the fourth with a row. Genitalia shining red, the posterior forceps brown. Fifth sternite brown, the lobes subtriangularly produced and projecting obliquely downward.

**FEMALE.**—Front as wide as either eye, widening anteriorly from the vertex; second antennal segment reddish above; apical genital segments brown.

**TYPES.**—Holotype, male, and allotype, female, East London, Cape Province, February 1, 1925 (H. K. Munro). The holotype has been returned to Mr. Munro.

Superficially this species resembles *vulpinus* Fallén, but in addition to the black-striped femora lacks discals on the intermediate abdominal segments, the fifth sternite is differently colored and the pleural pile is black.

***Linnaemya neavei*, new species**

Legs reddish yellow; trochanters black; front coxae brown on inner surface; pleural pile yellow; third antennal segment not angulate near the base. Length, 10 mm.

MALE.—Head yellow in ground color, the upper part of the front and the occiput to the lower level of the eyes black, thickly white pollinose. Front three-fifths as wide as either eye; nine pairs of frontals, the upper pair strong and reclinate; ocellars long; parafrontals and vertex with yellowish hair, the former with a partial row of black hairs near the frontals; frontal vitta pale orange. Occiput white pilose; the black occipital cilia do not extend to the lower edge of the eyes. Cheeks almost half as wide as the eye-height, wholly whitish pilose. Proboscis not longer than the head, the palpi concealed. Antennae black; third segment broad, slightly widened at the truncate, very slightly oblique apex; arista thick, short pubescent, the penultimate segment four times as long as wide.

Thorax black, cinereous pollinose and wholly pale yellow pilose; humeri, sides of mesonotum, and the scutellum pale luteous. Scutellum with black hair and one pair of discals, some of the hairs stout.

Legs reddish yellow; front coxae broadly brown on their inner surface, the others mostly brown in ground color; trochanters and a small spot at the base of the femora brown; tarsi black.

Wings cinereous hyaline; veins luteous, becoming yellow at the base; epaulet brown. Squamae whitish. Halteres yellow.

Abdomen rusty reddish yellow, with a black median vitta that expands on each segment and extends entirely across the broad apex of the fourth segment; pollen yellowish cinereous, somewhat tessellate; hair black, the under side of the first and second segments with pale yellow pile; no discal bristles on the intermediate segments, the fourth with a row. Genitalia reddish, the posterior forceps brown. Fifth sternite brown, the apices of the lobes gently concave.

TYPE.—Male, east of Mt. Mlange, Portuguese East Africa, October 3–7, 1913 (S. A. Neave), in British Museum of Natural History.

This species closely resembles *angulicornis* Speiser but is readily distinguished by the brown epaulet and simple antennae.

***Linnaemya parcesetosa* Villeneuve**

*Micropalpus parcesetosus* VILLENEUVE, 1916, Ann. S. Afr. Mus., XV, p. 471.

Male, Njala, Sierra Leone, April 4, 1925 (E. Hargreaves); male, Yappi, Gold Coast, September, 1915 (Dr. J. J. Simpson); female, Doonside, South Africa, January 13, 1917; male, Makandi, South Africa, June 10, 1911 (F. G. Evans); male and female, Pretoria, Transvaal, January 14, 1914, and October 1, 1918 (H. K. Munro); male, Barberton,

Natal, May 17, 1913 (H. K. Munro); female, Du River Camp No. 3, Liberia (J. Bequaert).

***Linnaemya luckmani*, new species**

Abdomen rusty reddish yellow, with black median vitta and tessellate white pollen; epaulet brown; antennae black. Length, 10 mm.

**FEMALE.**—Head mostly yellow in ground color, the upper part of the occiput probably luteous or olivaceous; face and cheeks with white, the front and occiput with pale ochreous pollen, although the front may be mostly dark in ground color and bear white pollen. Front four-fifths as wide as either eye, widening anteriorly; nine pairs of frontals, the upper pair strong and reclinate; ocellars long; frontal hair black. Occiput white pilose, the black occipital cilia not extending to the lower edge of the eye. Cheeks half as wide as the eye-height, pale yellow pilose. Proboscis a little more than half as long as the head-height; palpi about twice as long as wide, with black apical bristle. Antennae black, the incisures narrowly reddish; third segment somewhat widened to the apex; penultimate arisal segment about three times as long as wide.

Thorax blackish, the humeri, sides of mesonotum, and the scutellum luteous; hair black on the dorsum, yellow on the pleura and sides of the mesonotum and scutellum. Scutellum with coarse black hairs and one or two pairs of discals.

Legs reddish; extreme bases and tips of the femora and the tarsi black.

Wings cinereous, the veins reddish basally; epaulet brown or brownish red. Squamae yellowish, the lower lobe rather grayish with yellow border. Halteres yellow.

Abdomen rusty reddish, the white pollen tessellate, the apices of the second to fourth segments increasingly widely shining, the fourth almost half bare; hair black, pale yellow on the under side of the first two segments. Abdomen with a rather narrow black median vitta extending from the base to the middle of the fourth segment. Second segment without discals, the third with or without one pair, the fourth with a row and a few irregularly placed ones on the basal half; second and third segments each with a pair of median marginals, the fourth with a row.

**Types.**—Holotype, female, and paratype, female, Ngare Narok, Masai Reserve, British East Africa, December 31, 1913, 6000 ft. (O. A. Luckman).

This species bears a close resemblance to *angulicornis* Speiser but is readily distinguished by the black-haired mesonotum.

***Linnaemya angulicornis* Speiser**

*Micropalpus angulicornis* SPEISER, 1910, 'Kil.-Meru Exped.' X, p. 138.

Female, east of Mt. Mlanje, Portuguese East Africa, October 3-7, 1913 (S. A. Neave), in British Museum of Natural History; female, Stanleyville, Congo, April 17, 1915 (Lang and Chapin); female, Sawmills, Rhodesia, April 2, 1913 (Janse); two males and one female, Balla Balla, Southern Rhodesia, March, 1931 (A. Cuthbertson); female, Salisbury, Southern Rhodesia, May 16, 1913 (ex *Cirphis* larva); female, Nelspruit tp., South Africa, October, 1927; two males and three females, Barberton, South Africa, August 1, 1913, June 7, 1913 (L. S. Harden-

berg); May 28, 1914, and November 18, 1927 (H. K. Munro); two males, Pretoria, January 5, 1919 (H. K. Munro); two males, Maroelapan, South Africa, September 11, 1915.

***Linnaemya alboscuteolata* Speiser**

*Micropalpus alboscuteolatus* SPEISER, 1910, 'Kil-Meru Exped.,' X, p. 138.

Two females, Lukolela, Congo, December 16, 1930 (J. P. Chapin); male and two females, Mt. Mlanje, Nyasaland, August 22, September 5, 9, 10, 1913 (S. A. Neave); female, Durban, Natal, November 15, 1924; female, Lake George, Uganda, June 6, 1911 (C. C. Gowdey); female, Masai Reserve, British East Africa, April 10, 1913 (T. J. Anderson); female, Tshibinda, Tanganyika, August 21-27, 1931 (Alice Mackie); female, Nyakasura, Toro, Uganda, August 21, 1931 (J. L. Shillito).

***Linnaemya nyasa*, new species**

Abdomen rusty yellow or reddish yellow, with a black spot on the first segment and sometimes a vitta or triangle on the second; no discals on second segment; thorax almost all yellow pilose. Length, 12 to 13 mm.

MALE.—Head yellow, the upper part of the front and half of the occiput dark in ground color, the pollen white or with brassy yellow tinge. Front half as wide as either eye; ten to twelve pairs of frontals, the upper pair strong and reclinate; ocellars fine and rather short; hair black, sparse. Occiput yellow pilose, with a row of several black bristles behind the cilia above; black occipital cilia ending before the lower edge of the eye, but there may be a row or more of black hairs extending on to the posterior part of the cheeks. Cheeks four-ninths as wide as the eye-height, usually yellow-haired but there may be a few scattered black hairs, especially behind. Proboscis hardly three-fourths as long as the head-height; palpi five times as long as wide, with black apical bristle and several hairs. Antennae brownish red, the third segment mostly black, the basal ones with brown areas; third segment moderately widened to the oblique apex; penultimate arista segment twice as long as wide.

Upper half of pleura, humeri, sides of mesonotum, and scutellum rusty yellowish in ground color, the mesonotum and lower half of the pleura blackish; pollen yellowish cinereous; pile wholly pale. Scutellum with coarse black hairs on the disc and one pair of discals.

Legs reddish yellow, the tarsi black.

Wings cinereous, the basal half broadly yellow in front, the veins bordered with brown beyond the middle of the wing. Epaulet reddish yellow. Squamae pale yellowish or almost white. Hapteres yellow.

Abdomen shining rusty reddish yellow, the depression of the first segment and a vitta or apical triangle on the second black, the broad apex of the third segment and the fourth, dark, rusty reddish; second and third segments each with a linear white pollinose band on the base, the fourth white pollinose on the basal half or more in some views. Second segment without discals, the third with a pair, second and third each with a pair of median marginals, the fourth with a row of marginals and discals. Hair black, yellow on the under side of the first segment.

**FEMALE.**—Front two-thirds as wide as either eye; mesonotum with a few black hairs behind the suture and some coarse ones on the front margin; second abdominal segment without black spot.

**TYPES.**—Holotype, male, and allotype, female, Mt. Mlanje, Nyasaland; September 11, 1913. Paratypes: male and two females, Mt. Mlanje, November 3, 1912, and September 10 and 16, 1913, all collected by Mr. S. A. Neave. The types are in the British Museum of Natural History.

### ***Linnaemya lamborni*, new species**

Abdomen pale, the second segment with a blackish vitta and without discals; wings strongly bicolored; mesonotum with black hair. Length, 11 to 12 mm.

**FEMALE.**—Head yellow in ground color, the upper part of the front and the upper half of the occiput blackish, densely whitish pollinose, the frontal pollen with yellowish tinge. Front about three-fifths as wide as either eye, widening anteriorly from the vertex; eight or nine pairs of frontals, the upper pair strong and reclinate; ocellars long; parafrontals with black hair. Occiput white pilose, the coarse occipital cilia ending before the lower edge of the eye, but there may be a row or double row of black hairs extending to the posterior part of the cheeks. Cheeks two-fifths as wide as the eye-height, with rather long yellow hair, some of the hair sometimes black. Parafacials of almost even width, without hairs below the frontals. Proboscis two-sevenths shorter than the head-height; palpi five or six times as long as wide, reddish yellow, the apices sometimes black, the hairs mostly coarse and black. Antennae brown, the incisures broadly reddish; third segment not broadened apically; arista brown, the penultimate segment not twice as long as wide.

Thorax rather luteous, the pectus darker, the mesonotum black except on the broad posterior and lateral margins; hair yellow, black on the mesonotum except at the sides; scutellum with coarse black hair and one pair of discals.

Legs rusty reddish yellow, the tarsi black.

Wings brown on the subapical half, the apex cinereous, almost the basal half yellowish; epaulet reddish yellow. Squamae yellow, with white sheen. Halteres reddish yellow.

Abdomen rusty reddish yellow or reddish, the broad apex of the third segment more or less ferruginous and with black lateral triangles, the second with a median black stripe and a small black apical spot on each side, the first black in the depression. Hair black, yellow only at the base on the under surface. Second segment with a pair of strong median marginals, the third with a pair of strong discals and median marginals, the fourth with a row of discals and marginals.

**TYPES.**—Holotype, female, Ibadan, southern Nigeria, December 1, 1913 (Dr. W. A. Lamborn), in British Museum of Natural History; paratype, female, Ibadan, Olokemji, southern Nigeria (Bridwell Collection), in U. S. N. M.

This species is close to *nyasa*, new species, but the almost wholly black-haired mesonotum will distinguish it. In addition, the wings are much darker beyond the middle and there are other less conspicuous differences. It is to be expected that the male genitalia will also provide additional characters, since this is the case in other closely-related species.



***Linnaemya aculeatus* Villeneuve**

I have not seen a description of this species, but there is a specimen in the Vienna Museum, from northern Tanganyika, labelled as type of *Tachinomima aculeatus*.

Proboscis one-fourth longer than the head-height; front two-thirds as wide as either eye; frontal hair black; cheeks with mostly yellow hair; antennae reddish brown; penultimate arisal segment less than three times as long as wide.

Mesonotum black, the sides and small prescutellar spot reddish; pleura rusty reddish, the scutellum dark red, with numerous discals. Mesopleura, upper part of pteropleura and the mesonotum black-haired.

Legs reddish, the tarsi black.

Wings brownish, darker in front and basally. Squamae light brownish. Halteres yellow.

Abdomen shining dark reddish, the second segment with two rows of spines in the middle, the third with a row of marginals and discals and some scattered median discals; fourth segment with three rows of spines, the one extending across the middle strongest. Hair black.

***Linnaemya pilitarsis* Villeneuve**

*Tachinomima pilitarsis* VILLENEUVE, 1913, Rev. Zool. Afr., III, p. 27.

Male, Ibanda, Uganda, November 26, 1911 (C. C. Gowdey); male, Umtali, Southern Rhodesia, September, 1927; male and two females, Salisbury, Southern Rhodesia, November, 1929, August, 1932, and September 30, 1932 (A. Cuthbertson); two females, Nyakasnea, Toro, Uganda, October, 1931 (J. F. Shillito).

This is an easily recognized species. There are four or five pairs of postsutural dorsocentrals, the pile of the thorax is wholly black, and the rusty reddish or reddish-yellow abdomen has a wide black median vitta. In the male the arms of the posterior forceps are greatly modified and the outer forceps are explanate and curved, whereas the fifth sternite has a pair of median arms flanked on either side by a deep U-shaped excision. The epaulet in both sexes is brown, and the wings are cinereous with the costal border more or less luteous on the basal half. There are no infrasquamal setulae, the pteropleural bristle is quite short, and the proboscis is considerably longer than the head-height.

***Linnaemya ethelia*, new species**

Abdomen robust, shining rusty reddish; wings strongly bicolored, pleura black-haired. Length, 10 mm.

**FEMALE.**—Head yellow, the front darker, the upper part of the occiput blackish. Front a little narrower than eye, widening anteriorly; seven pairs of frontals, the

upper pair stronger and reclinate; ocellars long but fine; hair black. Occipital pile yellow, a few coarse black hairs near the vertex and a double row of black hairs extending from the occipital cilia to the cheeks. Cheeks half as wide as the eye-height, bearing long black hairs. Proboscis about three-fourths as long as the head-height, palpi about five times as long as wide. Basal antennal segments reddish, the third missing.

Thorax black, the upper half of the pleura, sides of the mesonotum and the scutellum reddish, the pollen yellowish. Scutellum with three pairs of discals and coarse black hairs.

Legs reddish; tarsi black.

Wings cinereous brown, obliquely yellow on the basal third; epaulet reddish. Squamae pale brownish red. Halteres reddish yellow.

Abdomen shining dark rusty red. Second and third segments each with a pair of discals, the fourth with a row; second segment with a pair, the third and fourth each with a row of marginals. Hair black, broadly yellow on the base of the under surface.

HOLOTYPE.—Female, Amani, Tanganyika, November, 1921 (A. H. Ritchie), in British Museum of Natural History.

Related to *pictipennis* Curran, but readily distinguished by the absence of pollen on the fourth abdominal segment, more evenly colored wings, etc.

#### *Linnaemya pictipennis* Curran

CURRAN, 1927, Amer. Mus. Novit., No. 253, p. 19.

The original description was based on two specimens taken at Stanleyville, Congo, in March.

The basal third of the wing is orange, the following half brown, and the broad apex brownish gray. The abdomen is robust, shining reddish, with the fourth segment rather thickly white pollinose, and the scutellum bears one pair of discals and coarse black hair.

#### *Linnaemya conformis* Curran

CURRAN, 1927, Amer. Mus. Novit., No. 258, p. 19.

Female, Isipingo, South Africa, May 25, 1922 (H. E. Irving); female, Port Shepstone, South Africa, August 22, 1920 (H. K. Munro); female, Illovo, South Africa, June 22, 1919; three females, Mt. Mlanje, Nyasaland, August 27 and September 26, 1913 (S. A. Neave); female, Solai District, Kenya, September 14, 1919 (T. J. Anderson); male, Ibanda, Uganda, May 24, 1911 (C. C. Gowdey); female, Kampala, Uganda, March 19, 1909 (C. C. Gowdey); female Ngare, British East Africa, December 31, 1913 (A. O. Luckman). The type series is also before me.

Pleura black-haired; scutellum with one pair of discals and coarse, short, bristly hair; trochanters and inner border of the front coxae black,

the remaining coxae partly black; tarsi black. Abdomen with the first segment mostly black, the second with a median black vitta in the male. Palpi about three times as long as wide.

This species may prove to be the same as *tarsalis* Villeneuve.

***Linnaemya gowdeyi*, new species**

Abdomen shining rusty reddish; pleura black-haired, palpi short; basal antennal segments reddish. Length, 11 mm.

**FEMALE.**—Head yellow, front reddish, the upper half of the occiput black in ground color; pollen white. Front two-thirds as wide as either eye; seven or eight pairs of frontals, the upper pair long and reclinate; ocellars long and strong; frontal hair black. Occiput yellow pilose; occipital cilia replaced below by a double row of black hairs extending to the cheeks. Cheeks four-ninths as wide as eye-height, yellow-haired, sometimes with a few black hairs intermixed. Proboscis slightly longer than the head-height; palpi twice as long as wide, bearing only short hairs. Antennae reddish, the third segment mostly brown, slightly widening apically, the apex oblique and convex above; penultimate arisal segment not twice as long as wide.

Thorax black, with white pollen; upper half of the pleura, broad sides of the mesonotum and the scutellum reddish; hair black. Scutellum with a pair of strong discals and perhaps some short ones. Pteropleural bristle long.

Legs reddish, the tarsi black; pulvilli elongate.

Wings tinged with brown, the costal border yellowish on the basal half; epaulet orange. Squamae very pale brownish, the border orange. Halteres reddish yellow.

Abdomen shining rusty reddish, the apices of segments darkened, the fourth thinly pollinose laterally; depression of the first segment and triangles on the apices of the second and third black. Second and third segments each with pair of discals, the fourth with a row; second segment with a pair of marginals, the third with a row, the median pair widely separated from the others and with a weak pair between them, the fourth with a row of shorter, finer bristles. Hair black, yellow on the base of the under side.

**TYPE.**—Female, Mt. Ruwenzori, Uganda, 10,000 ft., May 15, 1911 (C. C. Gowdey), in British Museum of Natural History.

The male probably has an uninterrupted, median black vitta on the abdomen.

***Linnaemya victoria*, new species**

Abdomen shining dark orange or brownish red; thorax black-haired; antennae brown; coxae reddish. Length, 11 mm.

**MALE.**—Head yellow, front reddish, becoming black posteriorly, the occiput black in ground color on the upper half; pollen pale yellowish. Front half as wide as eye, the sides parallel on the upper two-fifths; eleven to thirteen pairs of frontals, the upper pair strong and reclinate; ocellars long and divergent; hair black. Occiput yellow pilose; occipital cilia long, replaced below by a double row of black hairs extending to the cheeks. Cheeks slightly more than one-third as wide as the eye-height, the hair mixed black and yellow, sometimes all black. Proboscis slightly

longer than the head-height; palpi twice as long as wide, with a long apical bristle. Antennae brown, the incisures and inner surface of the second segment brownish yellow; third segment moderately wide, widening to the oblique apex, the upper and lower corners rounded; second arisal segment three times as long as wide.

Thorax black, the sides of the mesonotum and scutellum brownish red, the pleura with some dark reddish areas on the upper half; hair black, the pollen cinereous white. Scutellum with black hair and several pairs of discals. Pteropleural bristle long.

Legs reddish, tarsi black; pulvilli long.

Wings brownish gray, the veins bordered with yellowish brown, the costal border rather orange on the basal half; epaulet reddish. Squamae light brownish, with yellow border. Halteres reddish yellow.

Abdomen shining dark rusty reddish, the fourth segment thinly white pollinose on the basal half. First and second segments each with a pair of discals, the fourth with a row; second and third segments each with a pair of marginals, the fourth with a row, the second with a pair of weaker median marginals between the strong pair, both rows of bristles on the fourth segment broadly interrupted in the middle. Hair black, yellow at the base on the under surface. Abdomen with most of the first segment, a vitta on the second and a black apical triangle on the third, black.

FEMALE.—Front two-thirds as wide as either eye, gradually widening from the vertex forward; three pairs of discal scutellars; pleura reddish on the upper half. Pulvilli short. Abdomen darker, the apices of the segments broadly darkened; fourth segment with a pair of discals in front of the broadly interrupted, regular row; first segment rather narrowly black in the middle, the second with a small apical spot, the third with a large apical black triangle.

TYPES.—Holotype, male, and allotype, female, Vumba, Southern Rhodesia, March, 1931. Paratype: female, Nyakasnea, Toro, Uganda, October 5, 1931 (J. F. Shillito).

Related to *gowdeyi*, new species, but the two are certainly distinct. In the female the presence of an extra pair of discals on the fourth abdominal segment, much more widely interrupted discal row of bristles, and the blackish antennae will distinguish this species.

#### *Linnaemya shillitoi*, new species

Abdomen dark rusty reddish, with trace of narrow median black vitta; hair wholly black; wings dark gray, darker in front. Length, 11 mm.

MALE.—Head yellowish-white pollinose, the front thinly so, seven-tenths as wide as either eye; nine pairs of frontals, the upper pair reclinate; hair black, rather fine; ocellars long. Occipital cilia black, extending to the cheeks; pile pale yellowish. Checks about half as wide as the eye-height, clothed with long yellowish and black hair. Proboscis black, shorter than the head-height; palpi red, about twice as long as wide. Antennae black; third segment broad, very slightly widening toward the apex, the upper apex broadly rounded; basal arisal segment about three times as long as wide.

Thorax black, the humeri, sides of the mesonotum, scutellum and most of the pleural suture reddish; pollen rather thin, cinereous; hair wholly black. Four pairs

of postsutural dorsocentrals; infrasquamal setulae present and strong. Pteropleural bristle long.

Legs reddish, the tarsi black; pulvilli of medium length.

Wings brownish gray, darker in front. Squamae brownish gray, with brown rim. Halteres orange.

Abdomen dark rusty reddish, with an interrupted slender median black vitta; apex somewhat darkened; second and third segments each with a pair of discals. Hair wholly black. Posterior forceps with a broad, transverse depression across their middle; outer forceps broad, convex above, concave below, the apex obtuse, with a small curved spur above.

HOLOTYPE.—Male, Makasura, Toro, Uganda, October 19, 1931 (J. F. Shillito), in British Museum of Natural History.

### *Linnaemya torensis*, new species

Abdomen dark rusty reddish, the intermediate segments with discals; wings dark cinereous with orange tinge in front on basal half; abdomen wholly black-haired; pteropleural bristle not extending to apex of squamae. Length, 12 mm.

MALE.—Head whitish pollinose, the face and cheeks with yellow tinge; front four-fifths as wide as either eye; nine pairs of frontals, the upper pair slightly reclinate, an additional two pairs opposite the antennae; hair sparse, rather fine; ocellars fairly weak. Occipital cilia long; pile pale yellowish; a row of black hairs behind the cilia. Cheeks half as wide as the eye-height, with sparse, black bristly hairs. Proboscis shorter than the head-height; palpi about twice as long as wide. Antennae reddish; third segment brown, rather wide, gently widening to the truncate apex; penultimate aristal segment twice as long as wide.

Thorax reddish, the sternopleura and mesonotum, except its sides, black in ground color; pollen cinereous; hair wholly black; pteropleural bristle ending considerably before the apex of the squamae; three pairs of strong postsutural dorsocentrals. Scutellum dark reddish, with coarse black hair.

Legs reddish, the tarsi scarcely darkened; pulvilli of medium length.

Wings brownish gray, darker along the veins, tinged with orange on the basal half in front. Squamae brownish orange; halteres pale orange.

Abdomen dark rusty reddish, the median vitta represented by small black spots on the apices of the segments, the apex of the abdomen somewhat darkened. Second and third segments each with a pair of discals. Hair wholly black. Posterior forceps rather narrow, tapering from the base to the acute apex; outer forceps long, with sub-parallel sides, the upper edge straight, the apex curved inward toward the body.

HOLOTYPE.—Male, Nyakasnea, Toro, Uganda, October 7, 1931 (J. F. Shillito), in British Museum of Natural History.

### *Linnaemya bequaerti*, new species

Abdomen dark rusty reddish, mostly clothed with reddish hair. Length, 12 mm.

FEMALE.—Head yellowish, front reddish, the upper half of the occiput black in ground color; pollen white, pale yellow on the front and occiput. Front a little more than two-thirds as wide as either eye, gradually widening anteriorly; nine pairs of frontals, the upper pair strong and reclinate; ocellars long; hair black. Occiput yellow pilose, a row of black hairs behind the upper cilia; cilia replaced below by a

double row of black hairs extending to the cheeks. Cheeks half as wide as the eye-height, yellow-haired. Proboscis one-half longer than the head-height; palpi very short, with apical bristle. Antennae reddish; third segment mostly brown, slightly widening to the obtuse, slightly oblique apex; penultimate arisal segment five times as long as wide.

Thorax reddish, the lower part of the pleura with some black areas, the disc of the mesonotum black. Pollen yellowish and white on the pleura, brownish yellow on the mesonotum; pile yellow on the pleura, and on the sides and posterior border of the mesonotum. Scutellum with reddish hair and several pairs of discals. Pteropleural bristle not reaching to the end of the squamae.

Legs reddish, including the tarsi.

Wings brownish gray, broadly yellow in front on the basal third; epaulet reddish. Squamae brownish orange. Halteres reddish yellow.

Abdomen dark orange, clothed with orange pile except on the dorsum of the first two segments; fourth segment with yellow pollen on more than the basal half. Second segment with two pairs of strong discals and a laterally interrupted row of marginals; third segment with five strong discals and a row of marginals, the fourth with row of discals and marginals.

Types.—Holotype, female, and paratype, female, Behungi, Uganda, April 4, 1927 (J. Bequaert); paratype, female, Tshibinda, Tanganyika, August 21-27, 1931 (Alice Mackie).

There are a few *infrasquamal setulae* situated in a horizontal row. The color of the pile distinguishes *bequaerti* from any of the known African species.

#### *Linnaemya aptus*, new species

Thorax yellow pilose; trochanters black; epaulet yellow. Length, 9 to 11.5 mm.

Male.—Head yellow, the upper half of the front and more than the upper half of the occiput black in ground color; pollen white, tinged with yellow on the front. Front two-thirds as wide as either eye, with almost parallel sides on the upper third; nine to eleven pairs of frontals, the upper pair strong and reclinate; ocellars long; hair yellow. Occiput pale yellowish pilose, the occipital cilia sometimes continued to the cheeks. Cheeks about two-fifths as wide as the eye-height, the hair yellow; two or three black bristles anteriorly. Proboscis three-fourths as long as the head-height; palpi four or five times as long as wide, with black apical bristle. Antennae black, the apex of the second segment reddish; third segment gently widening to the oblique apex; penultimate arisal segment not twice as long as wide.

Thorax yellowish, the disc of the mesonotum and the pectus black, thickly cinereous pollinose; pile yellow. Scutellum with stout bristly hairs and one pair of discals. Pteropleural bristle not quite reaching the apex of the squamae.

Legs reddish yellow; trochanters, a stripe on the inner border of the front coxae, spots on the other coxae and on the base of each femur and the tarsi, black, the femora with a large brown spot apically. Pulvilli elongate.

Wings cinereous hyaline, the costal border yellowish in front on the basal half; epaulet yellow. Squamae white. Halteres yellow.

Abdomen rusty reddish yellow, with whitish, somewhat tessellate pollen; hair black, yellow basally on the under side. Second and third segments each with a pair

of discals and median marginals, the fourth with a row of each. First segment black basally, the second with indications of a median vitta. Posterior forceps turned upward at the tip.

**FEMALE.**—Front four-fifths as wide as either eye; seven or eight pairs of frontals; no black hairs behind the occipital cilia; puvilli short.

**Types.**—Holotype, male, Bujoma Forest, Uganda, June 17, 1910 (C. C. Gowdey); allotype, female, Palango, Uganda, March 3, 1910 (C. C. Gowdey). Paratypes: male, Ibadan, southern Nigeria, December 2, 1913 (Dr. W. A. Lamborn); two females, Yapi, Gold Coast, November, 1915 (Dr. J. J. Simpson); two males, Talodi, Sudan, September 11, 1933, on grass (A. A. Salam). Types in British Museum of Natural History.

### *Linnaemya affinis* Corti

*Micropalpus affinis* CORTI, 1895, Ann. Mus. Civ. Genova, XXXV, p. 137.

Female, Boma, Congo, June 17, 1915 (Lang and Chapin); male, Kampala, Uganda, November 17, 1915 (C. C. Gowdey); female, Mt. Mlanje, Nyasaland, August 26, 1913 (S. A. Neave); male and female, Ngare Narok, Masai Reserve, British East Africa, December 31, 1913, about 6000 ft. (A. O. Luckman); female, Fort Portal, Uganda, October, 1931, and female, Nwamga, September 26, 1931 (E. G. Gibbins).

This species is extremely like *vulpinus* Fallén, but the abdomen is usually more reddish, the cheeks always have two or more coarse black hairs anteriorly, and the wings are more gray with the basal third or fourth more or less orange in front. The pteropleural bristle is long, extending to the apex of the squamae, and there are one or two very fine infrasquamal setulae.

Two of the specimens before me have been determined by Dr. Villeneuve, and I have accepted his identification of the species. However, it is possible that Corti's name applies to one of the other forms, but this cannot be determined without an examination of the type.

### *Linnaemya vulpinus* Fallén

*Tachina vulpinus* FALLÉN, 1810, Vet. Acad. Handl., XXXI, p. 283.

*Tachina variegata* WIEDEMANN, 1824, Anal. Ent., p. 42; 1830, 'Aussereur. Zweifl.', II, p. 311.

Two males, Weenen, Natal, August–September, 1923 (H. P. Thompson); three males, Pretoria, Transvaal, January 5, 1919; two males and female, Barberton, South Africa, August 13; two males and three females, Barberton, May 28, 1914, May 10, 1919, April 25, 1920, and August 24, 1924 (H. K. Munro); two males and two females, New Hanover, Natal, November 17 and December 16, 1913 (C. B. Hardenberg); female, New Hanover, September 13, 1915; two females, Gordon's Bay, January, 1919 (R. Voss); male, Kaapmuiden, South Africa, May 3, 1920.

I have examined the type of *variegata*. The species is easily recognized by the characters used in the key. The thorax is wholly yellow pilose, the mesonotum rarely mostly black-haired in the female, the palpi about twice as long as wide, pulvilli of male elongate and the abdomen tessellate in some views. African specimens are usually darker than most of those from Europe, but there is no difference in the genitalia, and some African examples are fully as pale-colored as any Palaearctic specimens I have seen.

***Linnaemya turbida* Brauer and Bergenstamm**

*Micropalpus turbida* BRAUER AND BERGENSTAMM, 1893, Denkschr. Acad. Wissensch., Wien, LX, p. 184 (Erigone, 1891, *nomen nudum*).

Female, Lake George, Uganda, June 15, 1911 (C. C. Gowdey); two females, Mt. Mlanje, Nyasaland, August 23, 1913 (S. A. Neave); female, Maiwale, Nyasaland, March 13, 1933 (A. W. Lamborn); female, Katanga, Congo, August 8–11, 1931 (J. Ogilvie); female, Kapepa, Uganda, July 2, 1931 (G. H. E. Hopkins); male, Kaia River, West Nile, Uganda, August, 1928 (G. H. H. Carpenter); male, Fort Portal, Uganda, October, 1931, (E. G. Gibbins). The type, from "Cape," has been examined.

Readily recognized by the strongly bicolored wings, yellow pilose pleura and black pilose mesonotum, reddish legs with only the tarsi black, reddish epaulet and rather long, slender palpi. The scutellum bears one long pair of discals and some short, bristly hairs, and the intermediate abdominal segments each bear a pair of discals and median marginals.

***Linnaemya* species**

A single female in rather poor condition, collected by Dr. J. J. Simpson at Yapi in the northern territories of the Gold Coast, differs from *vulpinus* Fallén in having the trochanters and epaulet reddish and the abdomen with less extensive black areas. It undoubtedly represents a distinct species but, owing to doubt about its preservation, I do not describe it.

***Linnaemya cuthbertsoni*, new species**

Second and third abdominal segments with some short, stout spines in addition to the bristles; pleura yellow-haired; epaulet reddish. Length, 12 to 13 mm.

MALE.—Head yellow, front reddish, the occiput black in ground color on the upper half; pollen white, yellowish on the front. Front about half as wide as eye; nine pairs of frontals, the upper pair strong and reclinate; ocellars fine; hair black. Occiput yellow pilose, with black hairs behind the upper cilia. Cheeks two-fifths as



wide as the eye-height, yellow-haired, but there may be one or two black hairs. Proboscis almost as long as the head-height, palpi about twice as long as wide, with yellow bristly hairs. Antennae brownish red or mostly reddish; third segment wide, the apex strongly oblique; penultimate arisal segment four times as long as wide.

Thorax reddish, the disc of the mesonotum and the pectus blackish; hair black, yellow on the pleura; mesopleura with some coarse, black, bristly hairs above. Scutellum with numerous short discals and one long pair; pteropleural bristle reaching to the apex of the squamae or nearly so. Infrascapular setulae present.

Legs reddish, the pulvilli elongate.

Wings brownish gray, the anterior border more or less luteous or yellowish on the basal half. Squamae whitish, with yellow border. Halteres yellow.

Abdomen dark rusty reddish, shining, the depression on the first segment black. Second and third segments each with a pair of long discals and several (variable in number) short discal spines; second segment with a pair of strong median marginals and some spines between them, the third with a row of marginals and a pair of median spines; fourth segment with a row of discals and marginals. Hair black, yellow basally on the under surface.

FEMALE.—Front half as wide as either eye, strongly widening anteriorly; seven pairs of frontals, frontal hair partly yellow; abdominal spines longer.

TYPES.—Holotype, male, Chirinda Forest, Southern Rhodesia, November, 1930 (A. Cuthbertson); allotype, female, Barberton, Cape Province, May 21, 1914 (H. K. Munro); paratype, male, Chirinda, Southern Rhodesia, October–November, 1911 (C. F. M. Swynnerton).

This species differs from *aculeatus* Villeneuve in having the pleura yellow pilose and fewer discal bristles.

### *Linnaemya longirostris* Macquart

*Micropalpus longirostris* MACQUART, 1843, 'Dipt. Exot.', II, part 2, p. 46 (f.).

*Micropalpus salmacinus* SPEISER, 1910, 'Kil.-Meru Exp.', X, p. 136.

Female, Umbilo, Natal, October 2, 1915 (L. Bevis); female, Ngare Narok, British East Africa, December 31, 1913 (A. O. Luckman); male, East London, Cape Province, November 19, 1921; male, Citrus, Transvaal, October 22, 1923; female, Durban, Natal, November 15, 1924; female, East London, May 4, 1924; female, Port Shepstone, August 7, 1920 (H. K. Munro); female, Kampala, Uganda, August 11, 1932 (H. Hargreaves), parasitic on *Heliothis obsoleta* (?); female, Nyakasuru, Uganda, August 2, 1931 (J. F. Shillito); female, Salisbury, Southern Rhodesia, August, 1932 (A. Cuthbertson); female, Stellenbosch, South Africa, November 30, 1925 (R. J. Nel); one female with incomplete data, June 1, 1932.

Proboscis decidedly longer than the head-height and projecting far beyond the anterior oral margin; antennae varying from black to brownish red, or reddish with the third segment black. Pleural pile pale, that on the mesonotum mostly black. Legs reddish, the tarsi becoming black

apically. Wings grayish, the veins in the middle sometimes bordered with pale brownish, the base very broadly yellowish in front. The abdomen is yellow to pale rusty reddish, with or without a median black vitta and with the broad apex of the third segment and a median band on the fourth black or at least darkened. The infrascapular setulae may be absent or represented by at most three hairs; the pteropleural bristle is long, and there are only three postsutural dorsocentrals.

***Linnaemya ingrami*, new species**

Legs reddish yellow, the tarsi black except basally; thorax yellow pilose; wings bicolor; epaulet yellow. Length, 10.5 to 13 mm.

**MALE.**—Head yellow, front somewhat darkened, the upper half of the occiput blackish in ground color; pollen white, sometimes more or less yellowish on the front. Front three-fifths as wide as eye; eight pairs of frontals, the upper pair longer and reclinate; ocellars moderately long; hair black. Occiput yellow pilose, a few inconspicuous black hairs behind the upper cilia, the cilia not extending to the cheeks. Cheeks almost half as wide as the eye-height, with yellow hair. Proboscis one-sixth shorter than the head-height; palpi about twice as long as wide, red, with black apical bristle. Antennae reddish, the third segment widening toward the strongly oblique apex, mostly brown or black; penultimate arisal segment three times as long as wide.

Thorax rather luteous, the pleura partly blackish, the mesonotum black in ground color except on the sides and posterior border, the whole rather ochraceous pollinose. Pile yellow. Scutellum translucent yellowish, with coarse black hair on the disc and yellow pile laterally. Dorsocentrals, 3-3; sternopleurals, 2-1.

Legs reddish, the tarsi mostly black.

Wings pale brownish or dark gray, the basal half pale orange, the apex and posterior border gray. Squamae with yellow tinge, the halteres pale orange.

Abdomen rusty yellowish, with or without an interrupted median black vitta composed of apical triangles on the second and third segment and the black basal spot, the apex of the third segment usually broadly ferruginous. Second and third segments each with a pair of discs. Median forceps united and ending in a long apical process; outer forceps rather broad, tapering, ending in a short hook.

**FEMALE.**—Front five-sixths as wide as either eye, widening from the vertex to the antennae, clothed with short black hair. Abdomen usually without black spots beyond the first segment.

**TYPES.**—Holotype, male, Nyasaland, April 28, 1913, and allotype, female, Mt. Mlanje, Nyasaland, August 27, 1913 (S. A. Neave). Paratypes: six females, Mt. Mlanje, August 27, and September 10, 11, and 24, 1913 (S. A. Neave); male, Ashanti, Gold Coast, 1915 (Dr. A. Ingram); female, Barberton, South Africa, June 9, 1925 (H. K. Munro); male, Kilossa, Tanganyika, June 6, 1921 (Loveridge); female, Nairobi, British East Africa, July, 1930 (Van Someren); male, Nogob. Ruiru, Magerema, July 1, 1932 (H. C. J.).

***Linnaemya andersoni*, new species**

Cheeks with yellow pile, the mesonotum almost all black-haired. Length, 10 to 12 mm.

**MALE.**—Front about two-thirds as wide as either eye, gradually widening anteriorly, the parafrontals rather olivaceous in ground color and only thinly pollinose. Ten pairs of frontals, the upper pair somewhat reclinate; hair sparse, long and coarse; ocellars long and strong; outer verticals not developed; occipital cilia very long. Pollen whitish, more cinereous yellow on the occiput. Occipital pile pale yellow. Cheeks a little less than half as wide as the eye-height, bearing only yellow hair. Proboscis extending beyond the anterior oral margin, not quite as long as the head-height; palpi brown, a little more than twice as long as wide, bearing a fine apical bristle. Antennae black the basal segments more or less brown or brownish red, the incisures reddish; third segment strongly broadened apically, the apex oblique, angular above, rounded below, sometimes more or less reddish on the lower basal half; arista black, the penultimate segment four or five times as long as wide.

Thorax rather luteous, the pleura and pectus more or less extensively black, the mesonotum black except on the sides and posterior border. Pollen rather ochraceous. Pile yellow, the mesonotal hair almost all black. Scutellum translucent reddish yellow, with coarse black hair, the sides narrowly yellow pilose. Pteropleural bristle reaching to the apex of the squamae.

Legs reddish yellow, the tarsi black. Coxae and trochanters wholly pale.

Wings grayish, yellow on the basal half in front. Squamae white with yellow tinge. Halteres reddish yellow.

Abdomen rusty reddish yellow, with the usual black spot on the middle of the first segment and a slightly darkened median vitta, the apex of the third segment more or less strongly ferruginous; median vitta, most of the fourth segment and extreme base of the third with yellowish-tinged pollen. Second and third segment each with a pair of discals. Hair black, the under side of the first and second segment with fine yellow hair. Genitalia reddish, the median forceps as long as the outer, slender on the apical half, the outer forceps rather narrow, tapering to near the apex.

**FEMALE.**—Front five-sixths as wide as either eye, widening from the vertex to the anterior border, the hair shorter than in the male.

**TYPES.**—Holotype, male, and allotype, female, Sonje Valley, Solai District, Kenya, September 14 and 15, 1919 (T. J. Anderson). Paratypes: male, Umtali, Southern Rhodesia, April, 1923; female, Nyakasura, Toro, Uganda, November 1, 1931 (J. F. Shillito).

**GYMNOGLOSSA Mik**

*Gymnoglossa* MIK, 1898, Wien. Ent. Zeitung., XVII, p. 211.

Stein places this genus near *Demoticus*, but it seems to come very close to *Linnaemya* as indicated by Mik, differing chiefly in having the apical cell petiolate, the third vein bristled to beyond the anterior cross-vein, and the two basal segments of the arista elongate. I have before me a species from South Africa which differs from *transsylvanica* Mik in having the petiole of the apical cell considerably longer, the third

antennal segment strongly angulate just beyond the arista, reddish femora, etc.

***Gymnoglossa munroi*, new species**

Third antennal segment strongly angulated near the base; pleura black-haired; all arisal segments long. Length, 8 mm.

MALE.—Head yellow, the parafrontals and upper half of the occiput blackish, the pollen white. Front one-fourth wider than either eye; seven pairs of strong frontals, two pairs of proclinate orbitals and a divergent pair; ocellars long and divergent; parafrontals with sparse black hair. Occiput white pilose; outer verticals long, the occipital cilia long and extending to the cheeks which bear two or three bristles and a few black hairs. Cheeks a little less than half as wide as the eye-height. Proboscis as long as the head; palpi entirely absent. Antennae reddish, the third segment brownish red, with darker apex; third segment gently widening to the apex, the basal fourth strongly produced above and forming a triangle; arisal segments subequal in length.

Thorax black, black-haired, white pollinose, the humeri, sides of the mesonotum and the scutellum luteous. Scutellum with coarse black hairs and a pair of discals. Pteropleural bristle very long, reaching to beyond the apex of the squamae.

Legs reddish, the tarsi black.

Wings cinereous hyaline; apical cell long petiolate; bend of fourth vein with long vein-like appendage; third vein bristled to beyond the anterior cross-vein; first vein bristled opposite the humeral cross-vein. Epaulet reddish yellow. Squamae white. Halteres yellow.

Abdomen rusty reddish-yellow, with pale yellowish, tessellate pollen, the apices of the third and fourth segments bare dorsally. Hair black. Second and third segments each with a pair of discals and median marginals, the fourth with row of discals and marginals and coarse, bristle-like hair. Genitalia small. Base of abdomen with pale hair on the under surface.

TYPE.—Male, Pretoria, Transvaal, December 22, 1927 (H. K. Munro), returned to Mr. Munro.

This species bears a very strong superficial resemblance to *Linnaemya angulicornis* Karsch, but the base of the third antennal segment is a little more strongly produced.



# AMERICAN MUSEUM NOVITATES

Number 752

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

Nov. 7, 1934

59.57,72 A (3/4)

## NEW AMERICAN ASILIDAE (DIPTERA). III<sup>1</sup>

By C. H. CURRAN

Descriptions of a number of new species from the Neotropical region are given in the following pages. The types are in The American Museum of Natural History.

### *Diognites maculatus*, new species

Pale-colored species, the abdomen with seven subquadrate black spots on either side; palpi black. Length, about 13 mm.

MALE.—Head reddish brown in ground color, the face and front yellowish, clothed with white pollen; frontal pollen with yellow tinge, the occipital pollen cinereous except in the middle and along the orbits; cheeks black. Hair white; occipital cilia mostly yellow, the upper one or two black, the postvertical bristles black; the row of bristles along the anterior oral margin white. Proboscis and palpi shining black, the latter with black hair on the apical segment. Antennae reddish brown, the hair black; second segment twice as long as the first, the third not twice as long as the basal two combined.

Mesonotum brownish-yellow pollinose with an olivaceous tinge, with a pair of rather narrow median brown vittae that are replaced before the scutellum by short vittae extending forward along the dorsocentral line, and a narrow vitta, interrupted at the suture, on either side; laterally the pollen has a whitish sheen. There are two pairs of strong dorsocentrals and the black hair is very short and sparse. Scutellum brownish-yellow pollinose, with a pair of long black bristles. Pleura mostly luteous in ground color and whitish pollinose, although on the upper part, especially on the mesopleura, there is a brownish-yellow tinge. The hair on the pleura is fine and white, the hypopleural bristles black.

Legs dull reddish-yellow, the apical tarsal segment ferruginous; coxae white pilose and with white bristles. Hair black, pale on the under side of the femora, though very sparse, yellow on the posterior surface of the posterior tibiae; bristles black.

Wings with luteous tinge, broadly cinereous apically and posteriorly; anal cell narrowly open; anterior cross-vein situated at the middle of the discal cell. Squamae yellow, with a few long yellow hairs on the outer half and very short, black hairs on the inner half. Halteres yellow.

Abdomen with a broad median brownish-yellow vitta, the sides whitish but with yellow tinge above and apically, the apices of the segments broadly yellowish, leaving a subquadrate or longitudinally rectangular lateral black spot on each segment, the spots wider than the median pale vitta, the first segment black with the sides white. Hair black, white on the sides. Venter yellowish pollinose and with pale yellowish hair. Genitalia ferruginous, with whitish hair.

<sup>1</sup>American Museum Novitates Nos. 425 and 487 comprise parts 1 and 2 of this series.

HOLOTYPE.—Male, Puerto Grande, Isla Puná, Golfo de Guayaquil, Ecuador, April, 1934 (F. Campos).

This species is related to *craverii* Bellardi but may be at once distinguished by the white face and mystax.

### TRICLIOSCELIS Roeder

This genus was originally compared with *Holcocephala* Jaenicke because of the shape of the head and thorax and with *Triclis* Loew on account of the wing venation. Actually it is very closely related to *Hoplistomerus* Macquart and I doubt if it can be maintained as a separate genus. The only difference I can find is the absence of tubercles on the posterior femora. There are four South American species, separable as follows.

#### TABLE OF SPECIES

- 1.—Face without black hair or bristles.....2.  
Face with some black bristly hairs above the oral margin.....*femorata* Roeder.
- 2.—Legs mostly reddish.....*burmeisteri* Roeder.  
Femora wholly black, the tibiae black or brownish red.....3.
- 3.—Abdomen golden except the segmental apices.....*salti* Curran.  
Abdomen shining black, the apices of the segments with transverse lateral pol-  
linose spots, the apical segments with entire fasciae.....*perfecta*, n. sp.

### *Triclioscelis salti* Curran

*Laphystia salti* CURRAN, 1931, Amer. Mus. Novit., No. 487, p. 18.

At the time this species was described it was indicated that it did not belong to *Laphystia*. It is undoubtedly congeneric with the species placed in *Triclioscelis* and is similar in color to *burmeisteri* Roeder, differing, however, in having the femora wholly black.

### *Triclioscelis perfecta*, new species

Black, with mostly cinereous pollen; hair of face white. Length, 11 mm.

FEMALE.—Head cinereous-yellow pollinose and with pale yellowish hair and bristles. Proboscis and palpi shining black, the latter with two or three ferruginous bristles apically. Antennae reddish, the first segment black; bristles pale yellowish. Occipital cilia hairlike.

Thorax wholly black in ground color. Mesonotum clothed with dense, appressed pale hair having a brassy-yellow tinge, the disc bare except along the suture. Mesopleura with similar hair above and some scattered pale hairs in the middle; propleura and hypopleura with pale yellowish hair; pleura with grayish-brown pollen. Scutellum with hair similar to that on the mesonotum but bare above the lower margin, the hair on the lower margin directed toward the apex.

Legs black; femora with pale yellow hair and black bristles, the tibiae and tarsi with silvery-white hair and white or yellow bristles; hair wholly short and appressed.

Wings with brownish tinge, especially on the basal half in front; apical cell short petiolate. Squamae and their fringe pale yellow; knob of halteres yellow.

Abdomen shining black, the hair short, black on the dorsum, wholly shining white with slight yellow tinge on the broad lateral margins, expanded to form lateral triangles posteriorly on the basal segments, the triangles increasing in length and forming entire, broad bands on the apical segments. Venter with rather brownish pollen and appressed, mostly black hair, but each sternite has indications of a band of silvery hair.

HOLOTYPE.—Female, Puerto Grande, Isla Puná, Golfo de Guayaquil, Ecuador, April, 1934 (F. Campos).

#### CEROTAINIA Schiner

Since the publication of the key to the species belonging to this genus I have received paratypes of *C. debilis* Hermann and also examples of a related species with the result that I am able to amend the key. The following couplets will replace couplets 18 to 22 in the original key. In the males of both *debilis* and *camposi*, new species, the hair on the basal abdominal segments is rather dense but does not conceal the ground color as it does in *argyropasta* Hermann and *aurata* Schiner.

18.—Third antennal segment one-fourth longer than the first.....19.

Third antennal segment not or scarcely longer than the first.....20.

19.—Fine hair of the face and front black (Peru).....*flavipes* Hermann.

Fine hair of the face and front yellow (Brazil).....*willistoni* Curran.

20.—Third antennal segment little more than half as long as the first (Panama).

*feminea* Curran.

Third antennal segment not more than one-fourth shorter than the first.....21.

21.—Scutellum golden-yellow pilose on more than the basal half, the pile, in the male, sometimes paler but longer, denser and strongly appressed.

*camposi*, n. sp.

Scutellum with at most a few yellow hairs basally.....22.

22.—Larger species, 8 to 9 mm., the bristles of the posterior tibiae black (Brazil, Bolivia).....*brasiliensis* Schiner.

Under 7 mm. in length; bristles of the tibiae yellow (Peru)..*debilis* Hermann.

#### *Cerotainia camposi*, new species

Black, the scutellum golden-yellow pilose, the apical third sometimes with black pile in the female. Length, 5.5 to 6 mm.

MALE.—Face and front yellow pollinose, the occiput cinereous. Face one-half longer than wide, with sparse, yellow hair and a pair of black bristles situated slightly below the middle. Front wide, the hair yellow, the mammiform ocellar triangle bearing a pair of black bristles. Occipital cilia rusty reddish or yellow; occipital pile almost white, at least below, yellowish toward the vertex. Palpi not free; proboscis black, bearing whitish hairs. First antennal segment longer than the width of one eye, the second one-fourth as long, the third three-fourths as long.

Thorax shining black, the mesonotum clothed with very short, appressed, yellow hair, a band between the wings mostly bare; pleura with cinereous pollen and whitish



pile. Bristles black, the notopleural bristle sometimes yellow, the mesopleura with one or two black bristles above. Scutellum with dense, appressed, yellow to golden-yellow hair, the apical margin shining, the hair longer and finer than on the mesonotum and concealing the ground color; apex with some upcurved bristly hairs, two or three pairs of which are black.

Legs black, the tibiae and tarsi reddish yellow; apical half or less of the posterior tibiae, apical segment of the anterior four tarsi and the apical three of the posterior tarsi black or brown. Hair yellowish, black on the upper surface of the femora; femora with some long, whitish hairs below, each tibiae with three long, fine, pale bristles below; bristles either black or yellowish; posterior basitarsi with a pair of dorsal bristles beyond the middle.

Wings cinereous, pale on the basal third; anterior cross-vein situated a little before the middle of the discal cell. Squamal fringe yellow. Halteres pale yellowish.

Abdomen shining black, closely and finely punctured except apically; basal three segments clothed with abundant, appressed golden-yellow pile, the apical segments with less abundant, appressed black pile. Venter with brownish-gray pollen and sparse pale hair.

FEMALE.—Hair of the thorax less abundant and mixed with black or brown behind the suture, on the scutellum more golden and shorter, the free border of the scutellum more broadly shining. Abdomen with only the sides of the first segment with yellowish hair.

TYPES.—Holotype, male, allotype, female, and paratypes, sixteen specimens of both sexes from Posorja, Ecuador (F. Campos).

### MALLOPHORA Macquart

Three of the species before me are evidently undescribed, as they do not agree with any of the published descriptions. A key to the Neotropical species represented in the Museum collection is given, and although this is far from complete it may assist in the determination of specimens.

#### KEY TO NEOTROPICAL SPECIES

- 1.—Scutellum entirely or almost entirely black-haired. . . . . 2.  
     Scutellum with the hair mostly yellow, at least on the apical half. . . . . 8.
- 2.—Posterior tibiae with a prominent patch of pale hair basally either in front or above. . . . . 5.  
     Posterior tibiae black-haired, at most a few pale hairs basally. . . . . 3.
- 3.—Abdominal hair reddish and yellow except at the base. . . . . *pluto* Wiedemann.  
     Abdominal hair practically all black. . . . . 4.
- 4.—Abdomen shining black; beard white. . . . . *nitidula* Hermann.  
     Abdomen opaque black; beard yellow. . . . . *lugubris* Arribalzaga.
- 5.—Posterior tibiae with yellow pile above on basal half. . . . . 7.  
     Posterior tibiae with white hair on basal half in front and below. . . . . 6.
- 6.—Posterior tarsi of male white-haired above; coxae black-haired. . . . . *schwarzi*, n. sp.  
     Posterior tarsi wholly black-haired; coxae yellow-haired. . . . . *minos* Wiedemann.
- 7.—Wings blackish basally, brown apically, with broad, median pale band.  
     *tibialis* Macquart.  
     Wings brownish, becoming paler behind. . . . . *robusta* Wiedemann.

- 8.—Abdomen wholly black-haired. . . . . 9.  
Abdomen usually mostly yellowish or reddish-haired. . . . . 10.
- 9.—Front with a band of almost white hair. . . . . *breviventris* Macquart.  
Front with band of reddish-yellow hair; large species. . . . . *speciosa* Curran.
- 10.—Mesonotum wholly black-haired. . . . . *infernalis* Wiedemann.  
Mesonotum with pale hair, at least in front. . . . . 11.
- 11.—Scutellum with bright tawny pile; large, robust species. . . *rufiventris* Macquart.  
Scutellum with yellow or reddish-yellow pile. . . . . 12.
- 12.—Posterior tibiae wholly black-haired above. . . . . *ruficauda* Wiedemann.  
Posterior tibiae partly or wholly yellow-haired above. . . . . 13.
- 13.—Posterior tibiae with long, black hair on apical third or more. . . . . 14.  
Posterior tibiae with black hair on the apical fourth or less, or the hair is sparse and not conspicuous. . . . . 15.
- 14.—Anterior tibiae wholly clothed with long yellow or tawny pile. . . *antica*, n. sp.  
Anterior tibiae with black hair only (Cuba). . . . . *macquartii* Rondani.
- 15.—Basal antennal segments reddish yellow. . . . . 16.  
Basal antennal segments black or brown. . . . . 17.
- 16.—Anterior four femora with a black stripe above on the basal half. . . *abana*, n. sp.  
Anterior four femora wholly reddish. . . . . *callida* Fabricius.
- 17.—Posterior tarsi wholly black. . . . . *nigritarsis* Fabricius.  
Apical one or two segments of the posterior tarsi orange. . . *fusca* Bromley.

### **Mallophora schwarzi, new species**

Related to *minos* Wiedemann, but the posterior tarsi bear white hair above on the apical four segments and in front on the basal segment, and the wings are blackish on the basal third and pale reddish-brown apically. Length, 20 to 22 mm.

MALE.—Face shining black, the orbits narrowly cinereous pollinose; front brownish, the occiput with cinereous pollen; hair yellow, black on the sides of the mouth and a few black bristles on the sides of the mystax. Proboscis shining black and bearing black hair; palpi black, yellow pilose, usually with a number of black bristly hairs on the outer surface. Antennae black, the basal segments shining brownish, yellow-haired, the second segment with several black bristles; arista brownish yellow, slightly shorter than the third segment.

Thorax rather dull black, the pleura with rich brown pollen; pile black, a band of yellowish hairs on the front of the mesonotum, sometimes restricted to the median fourth, and always extending back in the middle, sometimes to behind the middle of the mesonotum. Scutellum and propleura without yellow hair.

Legs castaneous; coxae wholly black-haired; femora with black hair, the front and middle pair with a little yellow hair below and behind, the posterior femora rather slender and with a broad stripe of pale yellowish hair anteroventrally, the pale hair not reaching the base, or doing so only obscurely. Anterior four tibiae and tarsi with black hair. Posterior tibiae with rather long black hair, especially toward the apex, anteriorly with a large patch of white hair at the basal third and ventrally with a very large patch of white hair at the middle, the pale hair sometimes extending almost to the base, on the posterior surface with white hair intermixed with the black on the lower edge, except apically. Posterior tarsi black-haired, the apical four segments with conspicuous white hair anteriorly on the upper surface, the basal segment with white hair in front.

Wings blackish on the basal third, yellowish brown apically. Squamal fringe black. Halteres reddish with brown knob.

Abdomen dull black; first segment black pilose, the second to fourth pale yellow pilose, although the second and base of the third may be pale orange, the apical segments densely orange pilose; bases of the third and fourth segments sometimes with medianly interrupted bands of black pile basally. Venter yellow pilose although there may be alternate bands of black and yellow pile basally. Genitalia shining black, the hair tawny but becoming yellow on the apical part.

Types.—Holotype, male, and three male paratypes, Barro Colorado Island, Canal Zone, February 26, 27, March 9, 24, 1933 (H. F. Schwarz, E. I. Huntington), the first mentioned the holotype.

### ***Mallophora antica*, new species**

Related to *macquartii* Rondani but the anterior four tibiae are wholly clothed with pale orange pile. Length, 15 to 19 mm.

MALE.—Head black, the face and front yellowish-brown pollinose, the former with a shining black triangle above the swelling; occiput with cinereous-yellow pollen and black hair, the orbits with reddish or yellow hair, the beard yellow; front and face with black hair, the mystax with bristly yellow hair in the middle. Proboscis black, with pale hair; palpi black, clothed with coarse black hair above and yellow hair below. Antennae black, the basal segments mostly reddish, the third very long and tapering; hair black.

Thorax dull black, the pleura with brownish pollen; hair black, yellow on the scutellum and sides of the prothorax.

Legs reddish, coxae black, the anterior pair yellow pilose; anterior four femora with a broad anterodorsal black stripe on the basal third or more and with the base more or less blackened, the posterior femora with black base and upper apex and almost the whole ventral surface blackish or castaneous; posterior tibiae black on almost the apical two-thirds, their tarsi wholly black; hair black on the femora, except at the apex, and on the black part of the posterior tibiae and tarsi, orange on the anterior tibiae and tarsi, although the front tibiae have some white hair in front, and the posterior tarsi, when viewed from the base, have silvery-white hair on more than the anterior half of the apical four segments.

Abdomen dull black in ground color, the basal three segments thickly clothed with yellow pile, the fourth and following with black hair, the sides of the first segment either with black hair or black and yellow mixed. In the paratype the black hair extends over the middle of the third segment and forms a black triangle on the apex of the second. Venter with black hair, toward the apex with the hair mostly yellow in the holotype, all black in the paratype. Genitalia shining black, with silvery hair basally on the upper surface, the upper lamellae with whitish hair at the apex.

Types.—Holotype, male, and paratype, male, São Paulo, Brazil (Count A. A. Barbiellini).

Despite the different arrangement of the pile on the abdomen I believe that these two specimens represent the same species. Count Barbiellini has in his collection a specimen agreeing in color with the holotype, but no additional examples agreeing with the paratype have been captured by him.

**Mallophora abana**, new species

Rather similar to *nigritarsis* Fabricius but with the basal segment of the posterior tarsi only a little longer than wide and without the white, appressed hair on the hind tibiae and tarsi. Length, 13 to 16 mm.

**MALE.**—Face reddish in ground color, densely yellowish pollinose, the mystax yellow, the sides of the oral opening with black bristles and hair. Front with brownish-yellow pollen and yellow hair, the orbits cinereous pollinose. Occiput cinereous-white pollinose and yellow pilose, without black bristles. Proboscis and palpi shining brown, pale-haired, the palpi with numerous black bristles above. Antennae reddish yellow, the third segment brown; hair yellow, the bristles on the second segment black.

Thorax black, rather thickly ochraceous pollinose, the mesonotum rather thinly so from dorsal view, with a pair of narrow, brown median vittae extending almost the whole length. Pile reddish yellow, black and sparse on the disc of the mesonotum, the bristles partly black, partly reddish. Humeri, posterior calli and lower surface of the scutellum reddish in ground color; scutellar hair all reddish yellow.

Legs reddish; coxae black, brownish-gray pollinose; anterior four femora broadly black on more than the basal half of the anterodorsal surface; hair reddish yellow; posterior tarsi clothed with black hair, the basal two segments and the fifth with reddish-yellow hair above on more than the anterior half, the posterior tibiae with sparse black hair above.

Wings pale yellowish-brown; apical cell widely open. Squamae with reddish-yellow fringe. Halteres orange.

Abdomen dull black, the basal four segments with long tawny hair except in the middle, the apical segments each with an apical band of yellow hair, their bases with short black hair. Venter with pale yellow pile that is thin on the bases of the segments. Genitalia shining black, the hair almost white, not dense above.

**FEMALE.**—Palpi wholly pale-haired; apex of posterior tibiae and the whole of their tarsi black-haired; the hair on the posterior tibiae almost white; lamellae of the ovipositor reddish.

**TYPES.**—Holotype, male, and allotype, female, Chapada, Brazil (Williston Collection).

The short, broad, posterior tarsi appear to be typical of this species and will readily separate it from *fusca* Bromley, *callida* Fabricius and other allied species.

**PROCTACANTHUS** Macquart

Coquillett, in 1910, selected *P. philadelphicus* Macquart as the type of this genus, a proceeding that may prove to be of considerable importance in view of the fact that most of the Neotropical species differ from it in the shape of the proboscis. Up to the present time the genus has been separated from its allies by the character of the long abdomen, which extends beyond the tip of the wings when they are directed backward. It will be found, however, that in some tropical species this is not the case: the wings extend to slightly beyond the tip of the abdomen in

the males. Under these circumstances the separation of species from *Eccritosia* Schiner and *Erax* Scopoli becomes rather difficult unless some other character is used.

I find that in all species having short abdomen the apical section of the proboscis is triangular in shape when viewed from the tip. The upper edge is produced laterally, usually as a very strong flange, while the lower edge is also thinned or compressed. In the typical species of *Proctacanthus* the apical section of the proboscis is either round or more or less laterally compressed, usually widest toward the bottom. The gap between these two extremes is not bridged in the species before me, although two Nearctic species, *hinei* Bromley and *rufus* Williston, have the triangular development much weaker than in other species of the group. These two species belong to the Nearctic fauna and are the only ones I have seen from the region that have the proboscis of this type. On the other hand the only species with the typical type of proboscis that I have seen from the Neotropical region is *vittatus* Olivier, occurring in the West Indies.

Despite this striking difference in the shape of the proboscis, I hesitate to erect a new genus as my material is much too limited. However, it would seem that this might be the proper procedure provided no stronger connection is found than that already indicated.

Most of the Neotropical species I have seen agree with the description of *tibialis* Macquart and three of the species described as new were determined as that species. In the males all have the abdomen reddish beyond the second or third segment while in the females the abdominal segments are usually black with the apices very broadly reddish, sometimes colored as in the males, the ovipositor sometimes black. It is possible that some of the species described as new have been previously described, but it is impossible to identify them from the descriptions.

A key is presented to the species known to me in which the abdomen is extensively red in the males.

- 1.—Femora black, the tibiae reddish or yellowish, strongly contrasting. . . . . 8.  
Femora reddish, or if rather brownish, the tibiae of almost the same color. . . . 2.
- 2.—Face and palpi wholly clothed with pale hair and bristles or with only a few black bristles. . . . . 3.  
Sides of the face and the palpi clothed with black bristles. . . . *vittatus* Olivier.
- 3.—Males. . . . . 4.  
Females. . . . . 6.
- 4.—Ninth sternite with dense, long hair. . . . . 5.  
Ninth sternite with only short, sparse hair. . . . . *bromleyi* Curran.

- 5.—Dorsum of abdomen wholly clothed with short, coarse, black hairs, the sides with fine, pale hair; male genitalia rather short and narrow.  
*rufus* Williston.  
 Dorsum of abdomen, except the base, clothed with fine, pale yellow hair; male genitalia wider than apical abdominal segments.....*hinei* Bromley.
- 6.—Dorsum of the abdomen wholly clothed with fine, yellowish hair.....*hinei* Bromley.  
 Dorsum of the abdomen extensively clothed with coarse black hairs, at least in the middle.....7.
- 7.—Upper genital lamellae with discal spines.....*rufus* Williston.  
 Upper genital lamellae with only marginal spines.....*bromleyi* Curran.
- 8.—Face with many black bristles, at least along the oral margin.....9.  
 Face with pale pile and bristles, at most a pair of black bristles above the oral margin.....10.
- 9.—Apical lamellae of ovipositor with discal spines; anterior swelling of posterior coxae entirely yellow-haired.....*dina*, n. sp.  
 Apical lamellae of ovipositor with only the marginal row of spines; anterior swelling of posterior coxae at least partly black-haired.....12.
- 10.—Pleura almost wholly black-haired.....*fervidus*, n. sp.  
 Pleura yellowish-haired except above in front of the wings.....11.
- 11.—Beard and mystax white with yellow tinge; posterior tibiae yellow-haired except above.....*camposi*, n. sp.  
 Beard and mystax deep yellowish; posterior tibiae black-haired except behind.  
*fulviventris* Macquart.
- 12.—Swelling of the posterior coxae wholly black-haired; apex of the lateral forceps thickened and transverse.....*guianica*, n. sp.  
 Swelling of posterior coxae with mixed black and yellow hair; lateral forceps of male genitalia produced as a rounded lobe.....*salti*, n. sp.

### *Proctacanthus dina*, new species

Related to *guianica*, new species, but with discal spines on the apical lamellae of the ovipositor and the anterior swollen part of the posterior coxae bearing only fine yellow hair. Length, about 30 mm.

FEMALE.—Head cinereous pollinose, the facial swelling and lower part of the cheeks reddish in ground color. Hair black on the front and face, the face with some whitish hairs on the sides below; occipital cilia black; occipital pile and beard white. Palpi orange, the hair coarse and black on the outer side, finer and whitish on the inner surface; proboscis black, with reddish tip, the hair pale. Antennae blackish, pale pollinose, the second segment mostly reddish; hair black, yellow beneath the first segment.

Dorsum of thorax rather reddish-brown pollinose, with a pair of dark brown vittae on the anterior half, and one toward either side interrupted at the suture. Hair black, very short except posteriorly; three or four pairs of dorsocentrals behind; scutellar hair bristly and black, except narrowly on the sides. Pleura cinereous pollinose, more brown on the anterior third; hair yellow, black on the mesopleura and upper part of the sternopleura; hypopleura with a row of black bristles.

Legs black, the tibiae orange with darker tips; coxae cinereous pollinose and with fine, pale hair.

Wings yellowish brown, the costal cell mostly hyaline; anterior cross-vein oblique, ending a little beyond the middle of the discal cell. Border of the squamae brown, the fringe golden yellow. Halteres reddish yellow.

Abdomen black, yellowish-cinereous pollinose and reddish-yellow pilose, the sixth and following segments shining black; apices of the first to fourth segments yellow, of the fifth reddish. Each upper apical lamella of the ovipositor with an apical row of five large and two small spines and a discal row of three or four, the hair coarse and bristly; lower lamellae with rather strong marginal spines.

HOLOTYPE.—Female, Rio Caiary Uaupés, Amazonas, Brazil, October 3–15, 1906 (H. Schmidt).

From a comparison with related species it seems almost certain that the male of this species has the disc of the abdomen largely reddish. The female of *guianica* lacks the discal spines on the genital lamellae and has black hair on the anterior surface of the posterior coxae. The male of *bromleyi* can probably be separated from *guianica* by means of this latter character.

### ***Proctacanthus tibialis* Macquart**

MACQUART, 1849, 'Dipt. Exot.,' Suppl. IV, p. 88.

This species is unrecognizable from the description and, unless the type still exists, must remain unidentifiable.

### ***Proctacanthus camposi*, new species**

Abdomen reddish beyond the third segment, clothed with reddish-yellow pile; male genitalia clothed beneath with thick, pale golden pile. Length, 25 mm.

MALE.—Head thickly white pollinose and yellowish-white pilose, the facial gibbosity reddish in ground color; no black occipital cilia; a pair of black bristles above the anterior oral margin; lower posterior orbits rather golden. Proboscis and palpi black, clothed with fine whitish hair. Basal antennal segment black, cinereous pollinose, its apex and the second segment brownish red, the hair white, the bristles weak and black.

Thorax with cinereous pollen, a broad band extending over the mesopleura and sternopleura brownish yellow; disc of the mesonotum dull black in some views, pale pollinose and with narrow vittae from posterior view. Mesonotum with black hair, a few pale hairs above the roots of the wings; scutellum with mostly coarse yellow hairs, but some are black. Pleura clothed with whitish hair, the mesopleura with some black hair above; no bristles on the pteropleura.

Legs black, the tibiae reddish with the apical sixth black. Coxae cinereous pollinose and wholly clothed with pale yellowish hair, without bristles. Hair black, pale on the posterior surfaces of the femora and tibiae, on the posterior tibiae wholly yellow except on the dorsal surface and apex.

Wings hyaline, lightly clouded with luteous along the veins on the apical half; anterior cross-vein situated at the middle of the discal cell. Squamae reddish, with white fringe. Halteres reddish with partly brown knob.

Basal three abdominal segments and base of the fourth black, the apical segments reddish; apex of third segment and of the second toward the sides dark reddish;

basal four segments with thick, bright yellow pile, the pile very pale yellow on the sides of the first segment, rather golden on the fourth; fifth and following segments with inconspicuous reddish hair. Genitalia elongate, dark reddish, densely clothed below with pale golden, inwardly curved pile.

HOLOTYPE.—Male, Posorja, Ecuador (F. Campos).

### *Proctacanthus fervidus*, new species

A small species, the wings extending to slightly beyond the apex of the abdomen in the male; abdomen reddish with the base and ovipositor black. Length, 19 to 21 mm.

MALE.—Head yellowish pollinose, the front and upper part of the occiput more or less brownish. Hair and bristles yellow, a few coarse hairs on the front and the occipital cilia black. Proboscis black, the hair pale; palpi orange, with yellow hair. Antennae black, the basal segments cinereous-yellow pollinose, the first with yellow hair below.

Thorax rich brown, indistinctly striped. Hair black, pale yellow on the prosternum, and some of the fine hair on the pteropleura and hypopleura yellowish; three pairs of dorsocentral bristles in front of the scutellum. Scutellum darker than the mesonotum, less thickly pollinose, the hair wholly coarse and black.

Legs black, the tibiae reddish with black apices; hair black, yellow on the posterior surfaces of the tibiae; coxae rather brownish, the anterior four with mostly yellow pile, the posterior wholly black-haired.

Wings strongly tinged with brown; anterior cross-vein oblique, situated well before the middle of the discal cell. Squamae with brown border and black fringe. Halteres reddish yellow.

Basal two abdominal segments brown, the third brown on the sides, the following segments reddish; genitalia ferruginous; pile reddish yellow, long basally, very short on the apical segments; first segment black-haired in front.

FEMALE.—Agrees with the male but the abdominal pile is slightly shorter and the sixth and following segments form the shining black ovipositor. The upper lamellae each bear six long, stout marginal spines and the ventral lamellae each bear the same number of spines toward the apex below. The hair of the genitalia is wholly yellow.

YPES.—Holotype, male, allotype, female, São Paulo, Brazil. Paratype, female, São Paulo, collected by Count A. A. Barbiellini.

### *Proctacanthus salti*, new species

Abdomen red, with the sides of the first three and bases of the basal two segments black, the hair pale tawny. Length, about 27 mm.

MALE.—Head rather brownish-yellow pollinose. Hair of the front black, yellow anteriorly along the sides; occipital cilia black, extending far down; occipital pile white, the cheeks with some black bristles above. Face with coarse black hair, the broad oral region yellow-haired, with a row of strong black bristles. Facial swelling and cheeks reddish in ground color. Proboscis black; palpi reddish, clothed with white hair and with many black bristles on the upper and outer surfaces. Antennae black, the hair and bristles black except on the under surface of the first segment.

Thorax black, with yellowish-brown pollen, the mesonotum with a pair of almost entire median brown vittae, the sides, scutellum and much of the pleura more



brownish yellow. Hair black, pale on the narrow sides of the scutellum and on the anterior and posterior part of the pleura, the hypopleura with a row of black bristles.

Legs black, the tibiae orange with black apices; coxae with whitish hair, the anterior swelling of the posterior coxae with coarse black hairs mixed with the white. Hair mostly black, the tibiae with bright yellow hair posteriorly.

Wings yellowish brown; anterior cross-vein at middle of discal cell. Squamae with brown border, the edge with black hair above and golden below. Halteres reddish yellow.

Abdomen reddish, clothed with pale tawny pile; broad bases of the first and second segments, and sides of the first to third, black. Hair very short beyond the fourth segment; venter pale except at the extreme base. Genitalia shining dark reddish; upper forceps clothed with black hair except on the lower edge near the apex; lateral forceps strongly emarginate on the lower apical third, leaving a broad lobe on the upper two-thirds of the apex, the hair yellow except toward the apex; ninth sternite without long hair.

HOLOTYPE.—Male, Rio Frio, Magdalena, Colombia, July 2, 1927 (G. Salt).

#### ***Proctacanthus guianica*, new species**

Abdomen mostly reddish in the male; upper part of the face and the front brown; wings brownish. Length, 23 to 27 mm.

MALE.—Face reddish-yellow pollinose, the swelling reddish in ground color; front and face above the swelling brown pollinose, the hair wholly black, tawny on the face, yellow on the occiput; the beard white, but there is a little tawny hair in front. Proboscis black, the hair reddish yellow; palpi reddish, with reddish hair and a few black bristles toward the apex. Antennae black, the first segment with yellow hair below.

Thorax with cinnamon-brown pollen, the mesonotal vittae indistinct. Hair black, tawny on the sides of the scutellum and on the posterior part of the thorax; hypopleura with a row of black bristles; propleura with white pile below. A single pair of dorsocentrals.

Legs black, the tibiae reddish, the basal tarsal segment mostly dark reddish. Hair black, reddish yellow on the posterior surface of the tibiae; coxae with tawny hair, the anterior swelling of the posterior pair with black hair only.

Wings yellowish brown. Squamae with brown border, the fringe reddish yellow with a few black hairs above. Halteres reddish, with yellow knob.

Abdomen reddish, the broad bases of the first and second segments and the sides of the basal three blackish, the venter blackish on about the basal half; pile tawny. Genitalia ferruginous, the upper forceps black-haired, with yellow hair on the apical third along the inner edge; lateral forceps truncate and thickened at the apex, very slightly concave, almost transverse, clothed with sparse tawny hair; ninth sternite without dense hair, the hair mostly coarse and black.

FEMALE.—Hair black and bristly on the upper two-thirds of the facial swelling; palpi with scattered black bristles on the outer side; squamae without black hairs; sixth and following segments of the abdomen polished; each upper lamella of the ovipositor with six marginal spines.

Types.—Holotype, male, Kartabo, British Guiana, June 12, 1924; allotype, female, Bartica District, British Guiana.

The locality given by Macquart for *P. tibialis* was "South America" and as a result the species is not recognizable. The specimens described above have been recorded by Dr. Bromley as *tibialis* in my report on the Diptera of Kartabo.

### ECERITOSIA Schiner

This genus contains a small number of flies occurring in the American tropics and references are given to those species presumably belonging to the genus, together with a key for the separation of the species of which there are examples before me.

#### TABLE OF SPECIES

- 1.—Scutellum black pilose.....2.  
Scutellum yellow pilose.....*barbiellinii*, n. sp.
- 2.—Hair of the face entirely yellow.....3.  
Hair of the face black above.....*barbata* Fabricius.
- 3.—Lateral forceps of male genitalia ending in a broad, upwardly acute process below which there is an emargination, the apex of the forceps almost transverse above the process.....*amphinome* Walker.  
Lateral forceps of male genitalia ending below in an evenly rounded process, the forceps strongly oblique above the process.....*zamon* Townsend.

### *Eceritosia barbiellinii*, new species

Mesonotum mostly brownish ochraceous; scutellum wholly yellow pilose; legs black. Length, 23 mm.

MALE.—Head black in ground color, densely cinereous-yellow pollinose, the frontal pollen brownish except along the orbits. Hair of the front wholly black. Occipital hair very pale yellowish, the beard almost white; occipital cilia absent, but there is a double row of black and white bristles behind the middle of the eyes. Mystax entirely pale yellowish. Proboscis and palpi shining black, the hair whitish or pale yellowish, the palpi with a few black bristles apically. Antennae black, the third segment three times as long as wide, the arista becoming whitish on the apical half.

Mesonotum brownish ochraceous with the border cinereous except in the middle anteriorly; hair very short and black, somewhat longer before the scutellum. Scutellum black, brownish pollinose, densely clothed with long yellow hair. Pleura black-haired and rather dull black above, below and behind with dense yellowish pile; prothorax black-haired above.

Legs black; coxae with cinereous-yellow pollen, the hair white or yellow, the anterior coxae mostly clothed with black bristly hair; femora with rather sparse pale yellow hair, but on most of the upper surface with black hair; tibiae black-haired, the posterior pair with long whitish hair below; tarsal hair wholly black; bristles all black.

Wings hyaline, the veins rather clouded with yellowish brown on the apical half. Squamal fringe white. Halteres reddish brown.

Abdomen with the first and second segments black, the remainder orange; first segment clothed with long, pale yellow pile, the second with black pile, the third and fourth, and the venter, with whitish hair, the sides of the third and fourth segments each with a basal triangle of white pollen; fifth and following segments with inconspicuous yellow hair. Genitalia short, orange, the hair yellow.

HOLOTYPE.—Male, São Paulo, Brazil (Count A. A. Barbiellini). A second male is in Count Barbiellini's collection.

### ***Eccritosisa barbata* Fabricius**

*Asilus barbatus* FABRICIUS, 1787, 'Mant. Ins.,' II, p. 358.

*Asilus barbatus* OLIVIER, 1789, 'Encycl. Meth.,' IV, p. 264.

*Asilus barbatus* GMELIN, 1792, 'Syst. Nat.,' V, p. 2896.

*Asilus barbatus* FABRICIUS, 1794, 'Ent. Syst.,' IV, p. 379.

*Asilus barbatus* FABRICIUS, 1805, 'Syst. Antl.,' p. 155.

*Asilus barbatus* WIEDEMANN, 1821, 'Dipt. Exot.,' p. 187.

*Asilus barbatus* WIEDEMANN, 1828, 'Aussereur. Zweifl.,' I, p. 439.

*Proctacanthus barbatus* MACQUART, 1838, 'Dipt. Exot.,' I, part 2, p. 122.

*Proctacanthus*, *Asilus barbatus* WALKER, 1855, 'List Dipt. Brit. Mus.,' VII, pp. 652, 703.

SCHINER, 1866, Verh. zool.-bot. Ges. Wien, XVI, p. 684.

This species is readily distinguished by the presence of black hair on the upper part of the face. I have before me examples from Brazil and Panama.

It is possible that *Mallophora tricolor* Walker is the same as *barbata* although no definite conclusions can be reached from a study of the descriptions.

### ***Eccritosisa amphinome* Walker**

*Asilus amphinome* WALKER, 1849, 'List. Dipt. Brit. Mus.,' II, p. 387.

One specimen from Costa Rica. Originally described from Honduras.

*Mallophora tricolor* Walker has been placed as doubtfully synonymous with this species but is more likely the same as *barbata*.

### ***Eccritosisa ? antidomus* Walker**

*Asilus antidomus* WALKER, 1849, 'List Dipt. Brit. Mus.,' II, p. 408.

*Asilus antidomus* WALKER, 1855, 'List Dipt. Brit. Mus.,' VII, p. 652.

From the description this species appears to belong to the genus *Eccritosisa*.

### ***Eccritosisa zamon* Townsend**

*Proctacanthus zamon* TOWNSEND, 1895, Proc. Calif. Acad. Sci., (2) IV, p. 600.

Considered a synonym of *amphinome* Walker but distinct, as indicated in the key.

Townsend described the species from an excellent series taken in Lower California and the types were presumably deposited in the Cali-

fornia Academy of Sciences, and later destroyed. Fortunately five specimens of the type series found their way into the Wheeler collection and are now in The American Museum of Natural History. As a result of the study of these specimens it is obvious that *zamon* is distinct from *amphinome*, provided I have correctly identified that species.

***Eccritosia plinthopyga* Wiedemann**

*Asilus plinthopygus* WIEDEMANN, 1821, 'Dipt. Exot.,' p. 184.

*Asilus plinthopygus* WIEDEMANN, 1828, 'Aussereur. Zweifl.,' I, p. 432.

Described from Cuba and placed in *Eccritosia* by Schiner. It has not been rediscovered since originally described.

***PORASILUS*, new genus**

In my key<sup>1</sup> traces to couplet 95 where it agrees poorly with the characterization of *Antiphrisson* Loew, from which it differs in having the mystax composed of numerous bristles and hairs, instead of being clothed with fine, dense hair and bristles only along the oral margin. According to genital characters the genus is related to *Erax* Scopoli and even more closely to *Regasilus* Curran, but the mesonotal slopes are haired. The face is convex and strongly gibbous on the lower two-thirds, the dorso-central bristles, while weak, extend to well in front of the suture and the acrostical hairs form a more or less isolated median vitta; scutellum with rather fine hairs and three or four pairs of marginal bristles; posterior branch of the third vein ending slightly behind the tip of the wing; abdomen as in *Erax*, the male genitalia large, the ovipositor as long as the fifth to seventh segments combined, laterally compressed and shining black.

GENOTYPE.—*Porasilus barbiellinii*, new species.

***Porasilus barbiellinii*, new species**

Black in ground color and clothed with yellowish-brown pollen; sixth and seventh segments of the male silvery. Length, including genitalia, 18 to 20 mm.

MALE.—Face and front with brownish-yellow pollen, the occiput with cinereous pollen; hair reddish yellow; front and vertex with black hair, the occipital cilia fine, black, extending to the middle of the eyes, the upper three coarse and some of them may be reddish. Face rather deeply concave between the gibbosity and the base of the antennae; bristles of the mystax about half black. Proboscis shining black, the hair reddish yellow; palpi shining black, clothed with long reddish-yellow hair and bristles and with a strong, black apical bristle. Antennae black, the hair beneath the first segment reddish yellow; third segment about three times as long as wide; arista as long as the antennal segments, slightly widened before the acute tip.

Mesonotum, in some views, with a pair of brownish median vittae and very wide, interrupted lateral vittae. Prothorax and scutellum with reddish-yellow hair, a few of the scutellar hairs black and some of the hypopleural hairs reddish yellow; mesonotum with short, sparse black hair except along the middle, where it is longer, especially immediately in front of the scutellum; pleural hair rather long; scutellar bristles mostly reddish yellow.

Legs black, clothed with reddish-yellow hair, the tarsi and upper surfaces of the femora and tibiae with black hair; tibiae reddish yellow, the basal four tarsal segments reddish; coxae cinereous-yellow pollinose and with bright yellow or tawny pile; bristles black; anterior and middle tibiae with long hair posteriorly.

Wings with luteous tinge, brownish on a little less than the apical third; anterior cross-vein transverse, situated beyond the middle of the discal cell; anterior branch of the third vein with an appendage basally. Squamae with reddish-yellow fringe, the halteres reddish yellow.

Abdomen opaque, the sides very broadly cinereous pollinose, the pollen expanding triangularly so that it forms incomplete posterior fasciae on the second and third segments, the sixth and seventh segments, and sides of the fifth silvery pollinose; hair long basally and on the sides, yellow on the basal two segments, white beyond but brownish or brownish yellow on the disc of the fourth and fifth segments; venter cinereous pollinose and bearing white hair; eighth and ninth segments and genitalia with black hair, the segments more or less pollinose. Ninth sternite produced to form a long median lobe, its width not greater than its length. Genitalia large; widest, from dorsal view, toward the apex, bearing yellowish hair toward the apex above.

FEMALE.—Upper four or five pairs of occipital cilia coarse and black; mystax thinner; pleura almost wholly with reddish-yellow hair; posterior four femora and tibiae without black hair; abdomen pale pollinose on the basal five segments, the third to fifth each with a large basal black triangle when viewed from above; sixth and seventh segments subshining black, the fifth with some brown pollen on the sides, the hair black; hair on the basal segments yellowish, becoming white on the fourth and fifth; venter white-haired on the first to sixth segments; ovipositor bare except on the end lamellae and immediate base.

Types.—Holotype, male, and allotype, female, São Paulo, Brazil (Count A. A. Barbiellini). Additional specimens of both sexes are in Count Barbiellini's collection.

### ***Eraz imbuda*, new species**

Apical two abdominal segments silvery pollinose; facial tubercle prominent and strongly convex; mystax with black bristles and white hair; posterior branch of third vein ending just behind the wing tip. Length, 14 mm.

MALE.—Head black, cinereous pollinose; front with brownish-yellow pollen and black hair; ocellar triangle small and with a pair of large black bristles. Occiput with white hair, about seven pairs of the occipital cilia black; beard white. Facial swelling strong and very convex, as prominent as the apex of the first antennal segment, clothed with coarse, black bristles, the sides and lower third with white hair, the sides of the oral margin with three black bristles and black hair. Proboscis black, with pale hair; palpi black, clothed with long, coarse black hair, the base with long white hair. Antennae black, the hair and bristles wholly black; third segment elongate oval, about twice as long as wide.

Thorax black, clothed dorsally with yellowish-brown pollen, the pleura cinereous pollinose. Mesonotum with black hair which is short except posteriorly, where it is not unusually abundant; six or seven pairs of dorsocentrals, the anterior one or two weak pairs situated in front of the suture. Pleura with pale hair except on the mesopleura, the hypopleural bristles mostly black. Scutellum with three pairs of black and white bristles, clothed with white hair, but toward the base there are black hairs intermixed.

Legs black, the tibiae reddish, with black apices; coxae cinereous pollinose and bearing white hair and bristles; anterior four femora with black hair above and white below, the posterior pair pale yellow-haired and with a black dorsal and ventral stripe. Anterior four tibiae with black hair, the posterior pair almost wholly clothed with yellow hair; tarsi black-haired, the posterior surface of the first segment of the anterior pair and the anterior surface of the basal four segments of the posterior pair clothed with dense, short, yellow hair. Bristles black.

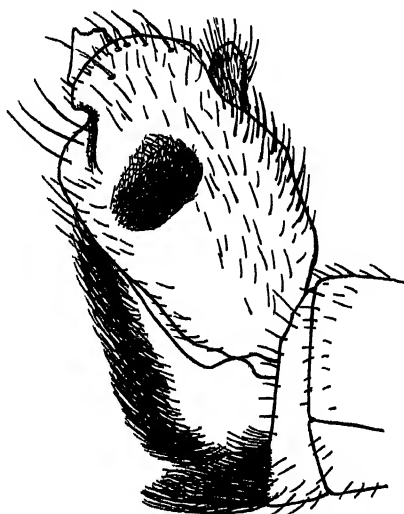


Fig. 1. *Erax imbuda*, new species.

Wings hyaline, luteous on less than the apical half. Anterior cross-vein situated at the apical third of the discal cell; anterior branch of third vein without appendage. Squamae with pale yellowish fringe; halteres reddish yellow.

Abdomen black, with brownish pollen, the broad apices of the segments cinereous, the broad lateral margin and venter cinereous pollinose. Hair pale yellowish, long on the sides of the first three segments and on the venter, black on the disc of the third segment and on the fourth and fifth, except on the sides; sixth and seventh segments densely white pollinose and with short yellow hair. Genitalia shining black, black-haired except on the upper margin of the upper lamellae; seventh sternite with dense, long black hairs on the apex. Upper lamellae emarginate below before the apex, the apex produced subdorsally; three bristles preceding the lower emargination.

HOLOTYPE.—Male, Porto Grande, Isla Puná, Golfo de Guayaquil, Ecuador, April, 1934 (F. Campos).

**Ommatius barbiellini**, new species

Related to *amula* Curran but at once distinguished by the absence of conspicuous whitish hair on the scutellum. The second posterior cell is noticeably narrowed beyond the middle and the costa of male rather strongly produced beyond the middle. Length, 11 to 15 mm.

MALE.—Head black, thickly pale brassy-yellow pollinose, the front with rich brownish-red pollen, the upper orbits and ocellar tubercle shining black, the tubercle bearing a pair of fine black bristles. Pile of the occiput and cheeks white, the upper four or five pairs of occipital cilia black. Face with three pairs of black bristles, the other bristles and hairs white or yellowish white. Proboscis shining black, the hair white; palpi black, with black hair and two or three fine black bristles, the hair on the basal segment white. Antennae black, with black bristles, the third segment about twice as long as wide.

Thorax yellowish-cinereous pollinose, the mesonotum reddish-brown pollinose, but appearing subopaque black from dorsal view, the sides, posterior border, and the mesopleura with brownish-red pollen, the mesonotal sutures with similar pollen. Hair on the pleura whitish; bristles of the mesonotum black, the dorsocentral lines and the sides with a few black hairs. Scutellum brownish red, with cinereous border, bearing a pair of marginal bristles and one or two pairs of pale yellowish hairs. No pteropleural bristles.

Legs reddish, the apical two-thirds of the posterior femora, dorsum and incomplete apex of the anterior four femora, apical third of the posterior tibiae and all the tarsi, blackish; apices of the anterior four tibiae brown. Coxae black, cinereous-yellow pollinose, the hair and bristles pale yellowish. Femora with yellowish hair, the upper surface, and most of the black portion of the posterior femora, with black hair, the bristles black; tibiae with yellow hair and very short black hair above, the posterior pair black-haired on the apical half; tarsi black-haired. Bristles of the tibiae mostly black, the anterior tibiae with two long, yellow posterior bristles, the middle pair with a single long, yellow ventral bristle.

Wings hyaline basally, luteous behind the costal swelling, the apex very broadly cinereous. Second posterior cell conspicuously narrowed before its end; anterior cross-vein situated before the middle of the discal cell. Squamae with pale yellowish fringe. Halteres yellow, the knob reddish.

Abdomen black, narrowest at the apex of the second segment, the base and apex of about equal width; broad sides and apices of the segments with cinereous pollen, that toward the bases of the segments on the sides more brownish. Venter with grayish-brown pollen, the apices of the sternites yellowish. Hair yellow, black dorsally on the apical segments and on the genitalia.

FEMALE.—Costa simple, the wings hyaline, the apex broadly cinereous or cinereous brown; abdomen less distinctly coarctate.

TYPES.—Holotype, male, allotype, female, and paratypes, male and female, São Paulo, Brazil (Count A. A. Barbiellini).







# AMERICAN MUSEUM NOVITATES

Number 753

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

Nov. 10, 1934

59.88, 6 (85)

## STUDIES OF PERUVIAN BIRDS. XIV<sup>1</sup>

NOTES ON THE GENERA *DENDROCOLAPTES*, *HYLEXETASTES*, *XIPHOCOLAPTES*, *DENDROPLEX*, AND *LEPIDOCOLAPTES*

By JOHN T. ZIMMER

I have been greatly aided in the preparation of this paper by certain comparative notes supplied by Mr. J. Berlioz of the Paris Museum, Dr. Herbert Friedmann of the U. S. National Museum, and Dr. C. E. Hellmayr of Vienna, for whose kind assistance I am very grateful.

Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

### *Dendrocolaptes certhia radiolatus* Sclater and Salvin

*Dendrocolaptes radiolatus* SCLATER AND SALVIN, "1867" = 1868, P. Z. S. London, p. 755—Yurimaguas, Perú; British Mus.

In a series of fourteen skins from the Ucayali, middle Marañón, and upper Amazon, in Perú, I can find no differences of note. East-Ecuadorian and southeast-Colombian (Amazonian slopes) material is similar, and fifteen examples from the right bank of the upper Rio Negro in Brazil show no constant differences and belong to *radiolatus*. Examples from the left bank of both upper and lower Negro and from the Cassiquiare (both banks) and the vicinity of Mt. Duida are all definitely *certhia*, which ranges thence to the Guianas and the Rio Jary, east of Manaos. In the light of the series from the upper Negro I am forced to conclude that Natterer's immature specimens from Marabitanas, referred by Hellmayr to *juruanus*, are *radiolatus*. None of the skins in hand agrees with *juruanus* or shows any tendency in that direction.

Young specimens of *certhia*, on the other hand, are notably inclined toward *radiolatus*, with barring above and below nearly as pronounced though the light portions are lighter, those on the top of the head especially distinct. Some adult examples are slightly more distinctly barred than others, but even in the Cassiquiare series I can find no very close approach to *radiolatus*. Both adults and young birds from all localities show a character that has received little attention but that seems to distinguish *certhia* very well from the other conspecifics. Below the

<sup>1</sup>Earlier papers in the series comprise American Museum Novitates Nos. 500, 509, 523, 524, 538, 545, 558, 584, 646, 647, 668, 703, and 728.

auriculars and sometimes involving their lower margins is a distinctly white or whitish patch, usually separated from the whitish throat by a dark line and standing out conspicuously against the surrounding darker areas. None of the other forms is similarly marked although the lower auriculars, malar, and gular areas, combined, are whitish in *medius*, without much approach to the condition shown by *certhia*.

Records of *radiolatus* in Perú are from Yurimaguas, Shanusi, Chamicuro, Iquitos, and Pebas, and several additional localities are added below in the list of specimens examined. Apparently this form keeps to the left bank of the lower Ucayali though it crosses to the right bank on the upper stretches of this stream. I have no examples from the right bank of the river opposite Sarayacu, but two birds from Orosa, south bank of the Amazon a short distance east of the mouth of the Ucayali, are not *radiolatus* but the following form.

***Dendrocolaptes certhia juruanus* Ihering**

*Dendrocolaptes juruanus* IHERING, "1904" = 1905 (May), Rev. Mus. Paulista, VI, p. 437—Rio Juruá, Brazil.

I have no topotypical material, but skins from the left bank of the lower Rio Madeira, Brazil, and from Orosa, Perú, agree in the characters that are ascribed to this form. The resemblance is closer to *radiolatus* than to *certhia*, but the decidedly finer dusky barring on a duller ground and the paler bill have no counterparts in a large series of *radiolatus*. The distinct barring, especially of the breast and back, and the barlike, rather than guttate, pale markings on the top of the head serve to distinguish *juruanus* from *certhia*.

Some of the specimens are very close to *polyzonus* as exemplified by a single male from the mouth of the Río San Antonio, Bolivia, but the latter is a little more warmly colored.

As noted under *radiolatus*, birds from the right bank of the upper Rio Negro, Brazil, should be referred to *radiolatus* instead of to *juruanus*.

***Dendrocolaptes certhia concolor* Pelzelin**

*Dendrocolaptes concolor* PELZELIN, 1868, 'Orn. Bras.,' I, p. 62—type locality restricted to Borba (Hellmayr, 1925); Vienna Mus.

A curious situation with respect to the present form leads me to discuss it here although its distribution is outside the limits of Perú.

A series of forty-one skins of the *certhia* group is at hand from the region extending from the right bank of the lower Rio Madeira, near Borba, to Pará. Of these, the birds from the immediate right bank of the

Madeira are typical *concolor*; the single Pará skin is typical *medius*. Those from the intermediate localities in part show a variation toward *medius*, varying in degree proportionate to the geographical approach, but in part remain perfectly typical *concolor*.

Thus, of seven birds from Villa Bella Imperatriz, three from the neighborhood of "Lago Andirá" are typical *concolor*; four from "Boca de Andirá" and "Serra de Parintins" are faintly duller in color, with a very little more whitish on the chin and with the obsolete bars on the under parts very slightly better developed. The differences are quite inconspicuous.

Of twelve birds from the Rio Tapajoz, six from the left bank are like the Villa Bella Imperatriz birds, with about the same range of variation. Six from the right bank are all a little lighter in color, somewhat inclined toward *medius*. Of eight birds from the right bank of the Xingú, five are like the Villa Bella Imperatriz examples while four are a little closer to *medius* than those from the right bank of the Tapajoz. Of nine examples from the right bank of the Tocantins, five are typical *concolor* and four are definitely assignable to *medius*.

I can find no ecological factors to account for the peculiar distribution here exhibited. Dr. E. Snethlage gives the habitat of *concolor* as "Urwald" and Dr. H. Snethlage refers *medius* to the same type of country. This phase of the problem must await future study in the field.

If *medius* were derived from *certhia* and *concolor* from *juruanus*, they might react differently on meeting than if *medius* were derived from *juruanus* and *concolor* from one or the other of these. Either possibility has points in its favor. An extensive series from various localities in the critical area might show some factors in the case that are not determinable with the material at hand. I have not found an exact parallel of this type of distribution and believe that an interesting problem here awaits future investigation.

#### SPECIMENS EXAMINED

*D. c. certhia*.—FRENCH GUIANA: Pied Saut, 2 ♂, 1 ♀; Tamanoir, 1 ♀. BRITISH GUIANA: Potaro Landing, 1 ♂, 1 ♀; Tumatumari, 3 ♂, 2 ♀; Kamakusa, 1 ♂; (no other locality), 1 (?). VENEZUELA: Sacupana, 1 ♀; (vicinity of Mt. Duida, various localities), 23 ♂, 11 ♀; Río Orinoco, mouth of Río Ocamo, 3 ♂, 2 ♀; opposite mouth of Río Ocamo, 2 ♂; Río Cassiquiare (left bank), Buena Vista, 1 ♂; Solano, 1 ♂; El Meroy, 1 ♂; (right bank), opposite El Meroy, 1 ♀. BRAZIL: Rio Negro (left bank), Manaos, 2 ♀; Tarira, 1 ♀; Rio Jamundá, Faro, 8 ♂, 3 ♀.

*D. c. radiolatus*.—BRAZIL: Rio Negro (right bank), Tabocal, 1 ♂; Tatú, 3 ♂, 2 ♀, 1 (?); Tahuapunto, 3 ♂; Iauarete, 1 ♀; Pirapucu, 1 ♂. COLOMBIA: Florencia, 1 ♂. ECUADOR: Río Suno above Avila, 1 ♀; Río Suno, below San José, 2 ♂;

mouth of Río Curaray, 1 ♂. PERÚ: Puerto Indiana, 1 ♂, 1 ♀; Pomará, 1 ♂, 1 ♀; Sarayacu, 2 ♂, 3 ♀; upper Ucayali, Santa Rosa, 1 ♀; Lagarto, 2 ♂, 1 ♀; mouth of Río Urubamba, 1 ♀.

*D. c. juruanus*.—PERÚ: Orosa, 1 ♂, 1 ♀. BRAZIL: Rio Madeira (left bank), Rosarinho, 6 ♂, 3 ♀; Santo Antonio de Guajará, 1 (?).

*D. c. polyzonus*.—BOLIVIA: mouth of Río San Antonio, 1 ♂.

*D. c. concolor*.—BRAZIL: Rio Madeira (right bank), Igarapé Auará, 2 ♂, 2 ♀; Villa Bella Imperatriz (Lago Andirá), 2 ♂, 1 ♀; (Boca Rio Andirá), 2 ♂, 1 ♀; (Serra de Parintins), 1 ♂; Rio Tapajoz (left bank), Igarapé Brabo, 3 ♂, 3 ♀; Rio Xingú, Tapará, 2 ♂, 1 ♀; Porto de Moz, 1 ♀; Rio Tocantins, Baião, 1 ♂, 1 ♀; Pedral, 1 ♂; Mocajuba, 2 ♀.

*D. c. concolor* × *medius*.—BRAZIL: Rio Tapajoz (right bank), Piquiatuba, 1 ♂; Aramanay, 2 ♀; Santarem, 2 (?); Tamucury, 1 (?); Rio Xingú, Tapará, 2 ♀; Villarinho do Monte, 1 ♂, 1 ♀; Porto de Moz, 1 ♂.

*D. c. medius*.—BRAZIL: Rio Tocantins, Baião, 1 ♀; Mocajuba, 2 ♂, 1 ♀; Utinga, near Pará, 1 ♂.

### *Dendrocolaptes picumnus validus* Tschudi

*Dendrocolaptes validus* TSCHUDI, 1844, Arch. Naturg., X (1), p. 296—Perú; forest region between 10° and 12° S. lat. = Chanchamayo region; Mus. Neuchâtel.

*Dendrocolaptes plagosus tardus* IHERING, 1907, 'Cat. Faun. Braz.,' I, p. 255—Rio Juruá, Brazil.

*Dendrocolaptes plagosus negrensis* SNETHLAGE, 1925, Jour. für Orn., LXXIII, p. 270—Acajatuba, right bank of lower Rio Negro, Brazil.

Six Peruvian skins from a variety of localities are fairly uniform in their characters. A female from Orosa has the pale portions of the under parts a very little whiter and less buffy than the average, and a male from the Río Távара is inclined the same way though to an even less noticeable degree. A male from Rosarinho, on the left bank of the lower Rio Madeira, Brazil, is like the Orosa skin in this respect, but the difference from the average Peruvian example is not great enough to warrant the recognition of *tardus*.

Three birds from the right bank of the upper Rio Negro are indistinguishable from *validus* though they obviously represent "*negrensis*." I am unable to locate the locality "Acajatuba" where the type of "*negrensis*" was obtained unless it is the same as the "Cajútuba" of Natterer, which is somewhere between Taruman (just above Manaos) and Ayrao. A single skin from Igarapé Cacao Pereira, about three and a half miles above Manaos but on the right bank of the Negro, is quite typical *picumnus*, as is a male from Manaos. It would appear that *picumnus* crosses the Negro near its mouth. Farther up, on the right bank, however, *validus* takes its place. The description of "*negrensis*" leaves no doubt as to its identity, which is further substantiated by the skins at hand from Yucabi and Mt. Curycuryari.

A young male from Río Seco, west of Moyobamba, Perú, differs quite noticeably from adults in a number of respects. The pale streaks on the top of the head and back of the neck are expanded into broad, lozenge-shaped spots, with the terminal margins of the feathers blackish and with suggestions of broken, dusky bars in the middle. The streaks on the anterior mantle are similarly widened while the lower mantle is rather prominently barred with dull rufous and blackish. The scapulars and upper wing-coverts also are noticeably barred. The stripes on the breast are enlarged like those on the head and are similarly supplied with paired spots or broken bars of blackish, here quite pronounced. The pattern has many points of resemblance to that of *D. certhia radiolatus*, but the bill is a *picumnus* bill and other features are not in accord with the *certhia* group.

I consider *pallescens* of southwestern Matto Grosso so closely allied to *D. p. seilerni* of northern Venezuela as to require its inclusion in the *picumnus* group. Two birds from northern Bolivia are even closer to *seilerni* in many respects and partly bridge the differences between that form and *pallescens*, but they are distinct in certain features of their own; *seilerni* is connected through *multistrigatus* with *validus*.

A male from Florencia, Colombia, and a female from Villavicencio, both from the Amazonian slopes of the eastern Andes, are not *multistrigatus* as found in the central valleys of Colombia but are much closer to *validus*. Neither is quite typical of that form. The Florencia bird differs, however, only by a somewhat greater warmth of color, and the Villavicencio skin by rather broader and more whitish stripes on the breast and darker brown, but not blackish, bill. The exact significance of the features of the Villavicencio bird is uncertain; there are some points of resemblance to *picumnus*.

Records of *validus* in Perú are from the type locality, Borgoña, Monterico, Ayacucho, Chamicuros, and upper Ucayali.

The north-Bolivian form, mentioned above, is described herewith.

#### ***Dendrocolaptes picumnus olivaceus*, new subspecies**

TYPE from Incachaca, province of Cochabamba, Bolivia; altitude 7700 feet. No. 137,413, American Museum of Natural History. Adult male collected May 18, 1915, by Leo E. Miller and Howarth Boyle.

DIAGNOSIS.—Similar to *D. picumnus pallescens* of southern Matto Grosso, Brazil, but general color beneath decidedly more olivaceous; pale areas and stripes tinged with pale Colonial Buff; auriculars more strongly tinged with rufescent; crown and mantle much darker; back with pale hair-streaks more prominent; under

wing-coverts and axillars with dark bars stronger, more blackish; bars on belly and under tail-coverts stronger and blacker; bill darker brown.

Compared with *D. p. seilerni* of northern Venezuela the differences are even less marked, but general color beneath more olivaceous with pale areas less whitish; top of head slightly lighter brown with pale stripes deeper buff; mantle a little more strongly streaked; auriculars more strongly tinged with rufous; bars on under wing-coverts and axillars a little heavier; bill of the same general color.

RANGE.—Tropical Zone of northern Bolivia.

DESCRIPTION OF TYPE.—Top of head light Sepia, each feather with a shaft-line of rather deep buff expanding slightly toward the end of the feather which has a blackish apical margin and several pairs of indistinct dusky dots along the outlines of the shaft-stripes; hind neck somewhat lighter brown, marked like the crown though less distinctly; mantle a little warmer than Dresden Brown; upper portion with narrow, whitish shaft-stripes outlined with dusky lines or dots; lower mantle with the streaks narrower and confined to the shafts, and with the dusky markings expanded into suggestions of ill-defined, broken cross-bars; rump and upper tail-coverts light Chestnut, duller and faintly barred on the upper portion, clearest on the tail-coverts. Lores whitish; a rather strong buff superciliary stripe, the feathers included in it margined with brownish; auriculars deep Amber Brown at tips, paler at bases, with the feathers outlined with blackish; chin dull, light Colonial Buff; throat similar with some dusky marginal markings; fore neck, breast, and sides of neck a little browner than Medal Bronze, with broad, tapering shaft-stripes the color of the throat, strongly outlined with blackish brown; belly and under tail-coverts buffy, with three or more distinct blackish bars on each feather; flanks a little darker, with markings more obscure. Wings light Chestnut, with tips of primaries somewhat shaded with dusky, and with dull brownish outer margins on the secondaries, less pronounced on the primaries, and obsolete on the tertials; upper wing-coverts like the back but with inner portions of the primary and greater series strongly chestnut; some suggestions of pale shaft-stripes and obsolete cross-bars present; under wing-coverts light ochraceous buff with relatively heavy cross-bars of blackish. Tail Bay. Maxilla (in dried skin) light brown; mandible paler, more yellowish; feet dull brown. Wing, 132 mm.; tail, 118; exposed culmen, 31; culmen from base, 38.5; tarsus, 28.25.

Dr. Hellmayr writes me concerning two skins from Río San Mateo, Bolivia, an adult female and an apparently young bird without given sex, that differ from the cotypes of *pallascens* in much the way that I have indicated for *olivaceus*. Río San Mateo is a locality in western Bolivia visited by Garlepp, but I have been unable to find it on any map. There is little doubt, however, that it must be included in the range of *olivaceus*.

#### SPECIMENS EXAMINED

*D. p. picumnus*.—BRITISH GUIANA: Potaro Landing, 1 ♂, 1 ♀; Tumatumari, 1 ♂, 1 ♀. BRAZIL: Faro, 4 ♂, 5 ♀; Colonia de Veado, Obidos, 1 ♀; Manaos, 1 ♂; Igarapé Cacao Pereira, 1 ♀.

*D. p. seilerni*.—VENEZUELA: Las Trincheras, 2 ♂, 2 ♀; La Trinidad, 1 ♂; La Latal, 1 ♂. COLOMBIA: Santa Marta, Las Nubes, 1 ♂; El Libano, 1 ♂, 2 ♀; Valparaiso. 2 ♂. 2 ♀, 1 (?).

*D. p. multistrigatus*.—COLOMBIA: Fusugasugá, 1 (?); Aguadita, 1 ♀; above Salento, 1 ♀, 1 (?); east of Palmira, 1 ♂; La Candela, 1 ♂; Cerro Munchique, 1 ♀. VENEZUELA: Pedregosa, near Mérida, 1 ♂<sup>1</sup>.

*D. p. validus*.—COLOMBIA: Florencia, 1 ♂<sup>1</sup>; Villavicencio, 1 ♀<sup>1</sup>. BRAZIL: Rio Negro, Yucabi, 1 ♂, 1 ♀; Mt. Curucuryari, 1 ♂; Rio Madeira, Rosarinho, 1 ♂. PERÚ: Río Amazonas, Orosa, 1 ♀; Río Ucayali, Lagarto, 1 ♂, 1 ♀; Río Távora, 1 ♂; Río Seco, west of Moyobamba, 2 ♂.

*D. p. pallescens*.—BRAZIL: Urucum, 3 ♂, 3 ♀; Belvedere de Urucum, 1 ♀; Piedras Blancas, 2 ♀. ARGENTINA: Perico, 1 ♂, 1 ♀; "Tañ trail," province of Tucuman, 1 ♀. PARAGUAY: Fort Wheeler, 1 ♂, 2 ♀.

*P. p. olivaceus*.—BOLIVIA: Incachaca, 2 ♂ (incl. type).

### ***Dendrocolaptes platyrostris platyrostris* Spix**

*Dendrocolaptes platyrostris* was recorded from Perú by Cassin on the basis of a specimen obtained by the Wilkes Exploring Expedition and labeled as from that country. The specimen, now in the U. S. National Museum, has been examined and proves to be a typical example of *platyrostris*, but the locality is certainly in error. The bird must have been obtained on the southeastern coast of Brazil, possibly at Bahia or Rio de Janeiro.

### ***Hylexetastes stresemanni undulatus* Todd**

*Hylexetastes undulatus* Todd, 1925 (May 26), Proc. Biol. Soc. Wash., XXVIII, p. 80—São Paulo de Olivença, Brazil; ♂; Carnegie Mus.

A young male from Lagarto, upper Ucayali, represents the first record of this species from Perú. I have no topotypical examples of *undulatus* for comparison, but four skins from Teffé agree with the description of this form and, in major details, with the Peruvian bird, thus covering localities on both sides of the type locality. I have no specimens of *stresemanni* for comparison, but the Teffé and Peruvian birds are distinctly olivaceous brown on the breast, much less warmly colored than *p. perrotii* or *p. uniformis*, though the upper parts are much like *perrotii*. The forehead lacks any trace of whitish shaft-lines as described for *stresemanni*.

The Peruvian bird matches the Teffé skins, as stated, in most particulars but differs in respect to some of the plumage of immaturity which has not yet been lost. Thus the throat and breast are almost as strongly barred as the belly though the bars of the throat and upper breast are broken by a buffy space corresponding to the shaft-stripes of the adults. A few adult feathers of normal appearance are coming into place. There are faint suggestions of broad dark bars on the uropygium,

<sup>1</sup>Not typical.



visible only at certain angles. The bill is dusky brown, paler cinnamonous brown on the mandible. In other respects the characters are those of the adults though a coarser texture of the feathers indicates the immaturity of some of these also.

A single male from the Rio Uaupés, Brazil, is recognizably distinct from *undulatus* in the opposite direction from *stresemanni* as described. Since it is without a name it may be known as follows.

***Hylexetastes stresemanni insignis*, new subspecies**

TYPE from Tahuapunto, left bank of the Rio Uaupés, Brazil. No. 300,415, American Museum of Natural History. Adult male collected July 5, 1929, by the Olalla brothers.

DIAGNOSIS.—Similar to *H. s. undulatus* from the south bank of the upper Amazon but more olivaceous, especially on the head and mantle; uropygium duller rufous; outer and longer upper tail-coverts tipped with buff and banded with dusky; whitish stripes of breast not outlined with dusky; color of breast clearer dark olive; upper flanks more olive with barring indistinct; under wing-coverts paler and more buffy, with dusky bars more broadly spaced; upper wing-coverts strongly olivaceous on the margins; under tail-coverts not notably rufescent. Bill shorter, as in *H. perrotii uniformis*. A suggestion of the whitish supramalar stripe of *H. p. perrotii* present. Forehead not streaked.

RANGE.—Region of right bank of the upper Rio Negro, Brazil.

DESCRIPTION OF TYPE.—Top of head and mantle near Light Brownish Olive, unmarked; rump and central upper tail-coverts Tawny; lateral and terminal upper tail-coverts duller, with tips ochraceous buffy and with rather prominent, broad cross-bars of dusky. Lores and subocular space whitish, continued less distinctly to the base of the auriculars; auriculars and sides of neck Buff Olive; malar region Brownish Olive in a broad stripe connected posteriorly with the sides of the neck and breast. Chin narrowly whitish; throat and breast with margins Buff Olive × Light Brownish Olive and with whitish shaft-stripes, broadest on upper throat, becoming obsolete on lower breast where, however, there are indications of faint dusky bars; sides of breast like breast but unmarked; flanks Light Brownish Olive with obscure bars; belly dull whitish with a tinge of olive-buff, distinctly barred with blackish; under tail-coverts barred with pale buff (faintly pinkish on lower portion) and dusky. Wings exteriorly pale Chestnut with outer margins of primaries olivaceous at base; upper wing-coverts rufous with outer margins and tips strongly brownish olive, concealing most of the rufous color of the central areas and inner webs; under wing-coverts whitish, with a slight buffy tinge, crossed by rather broadly spaced dusky bars somewhat broken at the shafts; inner margins of remiges Pinkish Cinnamon × Pinkish Buff; primaries dusky terminally, most broadly dusky on outer ones. Tail light Bay above, paler on ventral aspect. Bill (in dried skin) dark Liver Brown, brightest at base of mandible; feet dull slaty brown. Wing, 129 mm.; tail, 103; exposed culmen, 34; culmen from base, 40; tarsus, 31.5.

There is so much resemblance between *stresemanni* and its conspecifics and the *perrotii* group that specific distinction is not unquestioned. The

various forms represent each other geographically without overlapping ranges and the areas occupied by each are such as support conspecific forms of other species. However, material is rather limited and certain regions should be represented before a union is formally proposed.

#### SPECIMENS EXAMINED

*H. stresemanni undulatus*.—BRAZIL: Teffé, 3 ♂, 1 ♀. PERÚ: Lagarto, 1 ♂.

*H. s. insignis*.—BRAZIL: Tahuapunto, 1 ♂ (type).

*H. p. perrotii*.—BRITISH GUIANA: Potaro Landing, 1 ♂, 1 ♀, 1 (?). BRAZIL: Faro, 1 ♂.

*H. p. uniformis*.—BRAZIL: Rio Tapajoz (right bank), Caxiricatuba, 1 ♀; (left bank), Igarapé Brabo, 1 ♀; Igarapé Amorin, 3 ♀; Rio Jamauchim, Tucunaré, 1 ♀.

#### *Xiphocolaptes promeropirhynchus orenocensis* Berlepsch and Hartert

*Xiphocolaptes orenocensis* BERLEPSCH AND HARTERT, 1902, Novit. Zool. IX, p. 65—Nericagua, Venezuela.

A male from Sarayacu, lower Ucayali, Perú, compares very well with a male from El Merey, Río Cassiquiare, Venezuela, which I take to belong to *orenocensis*. A third male from the Tropical Zone of eastern Ecuador (below San José) belongs here also. The general appearance is very similar to *X. p. berlepschi*, though there is a somewhat browner (less rufous) tinge on the back, the throat is less purely white as are also the pale stripes of the breast, and the abdominal feathers lack the bright rusty hue so characteristic of *berlepschi*, being nearer Argus Brown or light Auburn. The bill is about equally heavy and pale in both forms.

The Peruvian bird has the top of the head a little less deeply blackish than the other two skins, but this is not an approach toward *berlepschi* which has the cap as dark as in the Cassiquiare and Ecuadorian skins I have referred to *orenocensis*.

I have not seen examples from the upper Ucayali and its tributaries (in the Tropical Zone), but examples from Pozuzo and La Gloria have been referred by Hellmayr to the following form, where they will be discussed more fully.

#### *Xiphocolaptes promeropirhynchus berlepschi* Snethlage

*Xiphocolaptes promeropirhynchus berlepschi* SNETHLAGE, 1908, Jour. für Orn., LVI, p. 15—Cachoeira, Rio Purús, Brazil; ♂; Mus. Goeldi, Pará.

Four males from Rosarinho, Rio Madeira, obviously represent this subspecies which has been recorded from the Purús to the Tapajoz. A single male from the Río Távora, southeastern Perú, agrees in most respects with the Rosarinho birds, being slightly smaller and less exten-

sively (but not less brightly) rusty on the margins of the abdominal feathers.

Specimens from Pozuzo and La Gloria, Perú, have been referred by Hellmayr to this form. I have no detailed notes about the Pozuzo bird but Berlepsch and Stolzmann's original account of the La Gloria specimen does not accord in all respects with any example of *berlepschi* now before me. The back and under parts are said to be more olivaceous and less rufous than in typical *promeropirhynchus*, but the reverse is true in the series at hand. However, the account does not apply any more accurately to *orenocensis*, and the record may be left with *berlepschi* for the present.

Records of *berlepschi* from Perú are from Yahuarmayo, La Gloria, and Pozuzo, in addition to the Río Távara from which I have a specimen.

***Xiphocolaptes promeropirhynchus lineatocephalus* (Gray)**

*Dendrocolaptes lineatocephalus* GRAY, 1847, 'Gen. Birds,' I, Pl. XLIII—no locality = Bolivia (1869, 'Handl. Gen. Sp. Birds,' I, p. 176); British Mus.

Recorded only once from Perú, from Huaisampillo. I have no Peruvian examples.

***Xiphocolaptes promeropirhynchus phaeopygus***

Berlepsch and Stolzmann

*Xiphocolaptes phaeopygus* BERLEPSCH AND STOLZMANN, 1896, P. Z. S. London, p. 377—Culumachay, near Maraynioc, Perú; ♂; Warsaw Mus.

A female from Chelpey, Junín, is very nearly topotypical. It agrees with the original description of this form in having the top of the head only faintly darker than the back and with the shaft-streaks nearly obsolete. The uropygium is hardly different from the back, though a slight rufescent tone is visible, a little better marked on the upper tail-coverts than on the rump. The under parts are darker and browner than in skins of *compressirostris* now at hand from northern Perú, and have the shaft-stripes somewhat narrower, though equally strongly outlined by blackish borders. The remiges are more purely rufescent on their exterior margins (less tinged with olive), and the throat is a little darker, with the individual feathers more strongly outlined with brownish.

Carriker (1933, Proc. Acad. Nat. Sci. Phila., LXXXV, p. 14) records specimens from Huacapistana, which are said to have the under parts paler than in *compressirostris*, without dusky margins on the pale shaft-stripes, and with the rump and upper tail-coverts more rufescent than in the more northern forms. Evidently these characters are highly variable

and the distinction of *phaeopygus* from *compressirostris* must rest largely on the more prominent streaking of the top of the head in *phaeopygus* and the slightly smaller size of the same form, though the latter needs greater confirmation. Possibly Carriker's birds show an approach toward *lineatocephalus* of Bolivia, which has a strongly rufescent rump and sometimes lacks the dusky margins of the ventral streaks. Records are from Culumachay and Huacapistana.

***Xiphocolaptes promeropirhynchus compressirostris* Taczanowski**

*Xiphocolaptes compressirostris* TACZANOWSKI, 1882, P. Z. S. London, p. 28—Ray-Urmana, Perú; ♂; type formerly in Warsaw Mus., now lost.

Three females from La Lejia, north of Chachapoyas, are referable to this subspecies although they are far from uniform. One, taken on March 19, is very dark, near warm Brussels Brown on the back and light Raw Umber on the breast. The other two, taken March 4 and April 16, are much paler. The March 4th bird is near Dresden Brown on the back and Light Brownish Olive × Isabella on the breast. The April 16th bird is a little darker, but not nearly so dark as the March 19th example, and has a trace of dusky outlines surrounding the shaft-streaks of the mantle, not found in the other two. All agree, however, in the relatively prominent streaking of the top of the head and the mantle, which distinguishes this form from *phaeopygus*, and in the relatively weak development of the rufous color on the uropygium, which distinguishes it from *ignotus*. While *ignotus* is usually more warmly colored than *compressirostris*, a female from Chical (western slopes of Mt. Naupan) is almost as light in coloration as the April 16th example of *compressirostris* from La Lejia. A female of *ignotus* from above Baeza, Ecuador, is almost as pale as the March 4th example of *compressirostris*, but both it and the Chical example have the uropygium more broadly and intensely rufous.

Records from Ray-Urmana, Tambillo, Chirimoto, Cutervo, and Leimebamba presumably all belong to *compressirostris*.

***Xiphocolaptes promeropirhynchus crassirostris***

Taczanowski and Berlepsch

*Xiphocolaptes crassirostris* TACZANOWSKI AND BERLEPSCH, 1885, P. Z. S. London, p. 113—Palmar [Río Tumbes, Prov. del Oro], Ecuador.

The only known Peruvian example of this pallid subspecies is a female from La Lajilla, now before me. The entire range of this form seems to be relatively limited, being restricted to a small area in southwestern Ecuador and northwestern Perú on the coastal side of the Andes.

The type locality, Palmal, Ecuador, is said to be a region of humid forests very different from the arid country around Tumbes, but I have little doubt that it represents the same semiarid margin of the true humid Subtropical Zone which I have discussed under *Grallaria ruficapilla watkinsi* (1934, Amer. Mus. Novitates, No. 703, p. 18). At El Chiral, at 5350 feet elevation, in the true Subtropical Zone, *X. p. ignotus* occurs just as *Grallaria r. connectens* replaces *G. r. watkinsi* at the same locality, while *watkinsi* is found at Alamor with *X. p. crassirostris*. The Peruvian locality, La Lajilla, is at only 1100 feet elevation, the highest point reached after crossing the Río Tumbes on a journey from Alamor to Tumbes. The distribution of *Xiphocolaptes promeropirhynchus* and that of *Grallaria ruficapilla* are thus very similar in this part of their specific ranges and, I believe, follow the same general zonal restrictions. The full limits of this "semiarid subtropics" have yet to be determined but probably follow along the slopes of the Andes for such distance as the humid Subtropical Zone comes under the influence of an immediately adjacent arid Tropical Zone; the lower portion of the Subtropical Zone, from near 1000 feet up to about 5000 feet, comprises the interesting habitat in question.

In the comparative study of typical *promeropirhynchus*, a possible clue to the identity of *Xiphocolaptes virgatus* Ridgway presented itself. The type of this "form" is not exactly like any other specimens at hand from any locality, but there is a strong resemblance to a male from Laguneta, Colombia, in most particulars. The differences between these two birds are the somewhat darker ventral color of the type (more nearly approaching a male from Salento), with the throat-feathers more noticeably bordered with brown. The points of similarity are the strong streaking on the head and back, the somewhat drab tone of the back, the pronounced streaks on the upper wing-coverts, and the vertically thick, relatively pale bill. In skins from Salento and Río Toche there is similarity in the shape and color of the bill, 11 mm. high at nostril, whereas the birds at hand from La Candela, La Palma, Aguadita, "Bogotá," and the Mérida region of Venezuela have a blacker and more slender bill, varying from 8.25 mm. to 10 mm. in height at the nostril, sometimes straight and sometimes strongly curved but apparently never so high as in the skins from the Central Andes of Colombia. On this character alone, therefore, it is possible to separate the central Andean specimens which may bear the name *virgatus* unless, or until, it can be demonstrated that the latter is better applied elsewhere.

My association of the *promeropirhynchus* and *orenocensis* groups

probably will be questioned, but I am unable to find a definite line of demarcation between them. Some examples of typical *promeropirhynchus* are quite similar in many respects to *orenocensis* and differ principally in the less blackish margins on the crown-feathers and the smaller and blacker bill. Specimens of *virgatus* are nearer to *orenocensis* in these respects though they differ from it in other details. A similar bill is found in *procerus*, and again in *crassirostris* where the top of the head becomes noticeably blackish. In short, it is possible to trace a fairly close degree of relationship through all the members of the combined group, though it is far from direct.

At all events, *orenocensis*, *berlepschi*, and, presumably, *obsoletus* are the representatives of the group in the humid Tropical Zone of the Amazonian basin; the other forms occupy the Subtropical Zone at various stations along the chain of the Andes.

In some respects, *crassirostris* is so close to *orenocensis* that I am inclined to the belief that it is a direct derivative of *orenocensis*, left on the Pacific side of the Andes when the mountains were uplifted, and modified, before or afterward, by close association with the more arid conditions developed on the coast. It does not, however, appear to belong to the humid Colombian-Pacific fauna as defined by Dr. Chapman, in which no member of this species is known to occur, but is subtropical, though, as suggested, of different immediate origin than *ignotus*, which occupies the higher and still more humid subtropical region but which is directly connected with *promeropirhynchus*.

In any case, the relationships are so close that segregation into two species becomes difficult.

#### SPECIMENS EXAMINED

*X. p. promeropirhynchus*.—VENEZUELA: Culata, 2 ♂, 1 ♀. COLOMBIA: "Bogotá," 3 (?); La Palma, 1 ♂; La Candela, 1 ♂, 2 ♀; Aguadita, 1 ♂, 1 ♀; Subia, 2 ♀; Montaña de Esmeralda, above Supata, Cundinamarca, 1 ♂.

*X. p. virgatus*.—COLOMBIA: [Antioquia?], 1 (?) (type); Salento, 1 ♂, 1 (?) ♀; Laguneta, 1 ♂; Río Toche, 1 ♂.

*X. p. sanctae-martae*.—COLOMBIA: San Lorenzo, 1 ♂, 1 ♀; Valparaiso, 2 ♂, 1 ♂; El Llano, 2 ♂, 1 ♀; Las Nubes, 1 ♀.

*X. p. procerus*.—VENEZUELA: Las Trincheras, 1 ♀; La Latal, 1 ♀; Carapas, 1 ♂.

*X. p. orenocensis*.—VENEZUELA: El Meray, Río Cassiquiare, 1 ♂. ECUADOR: below San José, 1 ♂. PERÚ: Sarayacu, 1 ♂.

*X. p. ignotus*.—ECUADOR: El Chiral, 2 ♂, 1 ♀; Baeza, 3 ♀; upper Sumaco, 1 ♂; Pallatanga, 1 ♂; Chical, 1 ♀; (no locality), 1 ♂.

*X. p. crassirostris*.—ECUADOR: Alamor, 2 ♂. PERÚ: La Lajilla, 1 ♀.

*X. p. compressirostris*.—PERÚ: La Lejia, 3 ♀.

*X. p. phaeopygus*.—PERÚ: Chelpes, 1 ♀.

*X. p. berlepschi*.—PERÚ: Río Távara, 1 ♂. BRAZIL: Rosarinho, 4 ♂.

*X. p. lineatocephalus*.—BOLIVIA: Incachaca, 1 ♀; Yungas, Prov. Cochabamba, 1 ♀; Pitiguaya, 1 ♀, 1 (?); Roquefalta, 1 ♂.

***Dendroplex picus peruvianus*, new subspecies**

TYPE from Santa Rosa, upper Río Ucayali, Perú. No. 240,421, American Museum of Natural History. Adult male collected November 17, 1927, by the Olalla brothers.

DIAGNOSIS.—Similar to *D. p. kienerii* of Tefé, Brazil, but coloration lighter and brighter rufous; throat deeper buff; dark margins of pectoral feathers browner, less blackish; top of head browner or grayer, less sooty, and with the pale central spots averaging larger; bill more extensively whitish.

RANGE.—Eastern Perú, at least along the course of the Río Ucayali.

DESCRIPTION OF TYPE.—Top of head grayish brown, darker at the tips of the feathers and with a large, ovate, central spot of pale buff; hind neck lighter, warmer brown, with pale spots more elongate; mantle light Auburn × Chestnut, with rather broad, whitish shaft-stripes anteriorly, reduced to hair-lines in the median portion, and obsolete posteriorly; rump and upper tail-coverts Chestnut × Bay. Lores pale buff, a fine, whitish line over the eye broadening over the auriculars where the feathers have narrow dusky tips; malar region light buffy, with dusky margins and tips broadest along the lines separating the area from the throat and auriculars; auriculars pale buffy with slight dusky margins, broadest on upper border where they form a dark postocular stripe; chin pale buff; throat deeper, near Pinkish Buff and with slight dusky margins and tips, broadest near the chest; upper breast with broad central spots of light buff, rounded at tips and outlined by a sooty brown margin; sides of breast and lower breast similar but stripes less heavily outlined, and margins of feathers warm Brussels Brown; belly warm Brussels Brown with narrow, poorly defined shaft-lines; flanks a little darker and tinged with Auburn, faintly streaked; under tail-coverts similar, with shaft-streaks more prominent. Outer surface of wings light Chestnut, clearer on tertials and lesser upper coverts, slightly duller on remainder; tips of primaries and secondaries dusky (up to about half of outer primary), not sharply defined; under wing-coverts Tawny × Ochraceous-Tawny; tail Dark Bay. Bill (in dried skin) dull whitish, dusky at base of maxilla; feet blackish slaty. Wing, 102 mm.; tail, 82; exposed culmen, 30; culmen from base, 34; tarsus, 22.5.

REMARKS.—Female similar to male but apparently with slightly shorter wing (single specimen, 98 mm.); other measurements not different.

One male, from Sarayacu, has the top of the head slightly sootier than the type; several from the type locality have the head decidedly paler and grayer or browner; others match the type. Nothing in the series of *kienerii* from Tefé approaches these skins very closely in these or the other diagnostic characters; they are darker in almost all particulars, including the color of the bill. Peruvian records from Moyobamba and Pebas probably belong with *peruvianus*.

Most skins from northern Bolivia (Todos Santos) and western Matto Grosso (Descalvados and Tapirapoan) show more affinity to the

Peruvian birds than to the Teffé series. They are not quite typical, however, and in the extreme development of the pale spots on the top of the head are very like Bahia specimens though they are more deeply colored. Their bills are shorter than those of most *peruvianus* (males: culmen from base, 29–30.5 mm., as against 30–34; females: 27.25–31, as against 32). They are far from uniform in coloration and a larger series from the region will be necessary to determine their true affinities. A young bird from Utiarity may belong to *picus* which occurs lower down the same stream, the Tapajoz.

One female from Igarapé Auará, Rio Madeira (right bank), Brazil, is even more rufous than *kienerii* or *peruvianus*, but it has the whitish bill and the light crown of *peruvianus* though the bill is relatively short (30.25 mm. to base), more like *kienerii*. The wing is 101 mm. Probably this represents an abnormal coloration since it is not approached in eleven additional skins from near the same locality.

A series of ten skins from Teffé I assume to represent true *kienerii*, though there is a little doubt about the application of the name, which will be discussed later. They are darker than *peruvianus* and more rufescent than *picus* from the Guianas and Faro, Brazil, with a slightly greater average wing-length than *picus* and with rather broader, less well-defined whitish stripes on the upper belly.

Skins from other points along the south bank of the Amazon, from the left bank of the Rio Madeira to the Tocantins, and on the right bank of the lower Rio Negro, north of the Amazon, are not clearly distinguishable from *picus* though there is a tendency toward a warmer tone, not at all constant, but sometimes pronounced.

Several skins from Manaus are somewhat clearly differentiated and have the pale stripes of the belly broader and noticeably outlined with blackish; but one or two more from the same locality are not clearly distinguishable from Faro skins. Those that are somewhat different appear to show a tendency toward the birds of the upper Rio Negro and the region of Mt. Duida, Venezuela, which, in turn, present sufficiently strong characteristics to warrant their description as a new form. It may be known as follows.

#### ***Dendroplex picus duidae*, new subspecies**

TYPE from Caño León, Mt. Duida, Venezuela: altitude 325 feet. No. 274,313, American Museum of Natural History. Adult male collected October 20, 1928, by the Olalla brothers.

DIAGNOSIS.—Similar to *D. p. picus* but throat purer white, less strongly marked with dusky; belly more strongly streaked with the stripes broader, whiter, and much



more distinctly margined with dusky; hind neck and upper part of mantle similarly marked with broad, whitish stripes conspicuously outlined with blackish.

RANGE.—Vicinity of Mt. Duida, Venezuela, and adjacent parts of the upper Orinoco, passing southward to the upper Rio Negro in Brazil and descending the right bank to Tabocal.

DESCRIPTION OF TYPE.—Top of head sooty brown with paler shafts and a small ovate spot near the tips, a blackish terminal border present beyond the pale spot; forehead with whole subterminal portion drab, not so pale as the shafts; nape with pale spots more buffy, less well-defined; hind neck and anterior part of mantle with margins and tips warm Argus Brown, separated from the broad white shaft-stripes by a prominent blackish line; rest of mantle Argus Brown with whitish shaft-lines only immediately adjacent to the anterior, broadly striped portion; uropygium light Chestnut. Lores whitish, continued over the eye and auriculars in a broad whitish stripe, with the feathers over the auriculars tipped and margined with dusky brown, increasingly prominent posteriorly and broadening on the sides of the neck to match the pattern of the upper mantle; malar region whitish with obsolete dusky tips but with a dusky line separating this area from the auriculars and another line bordering the throat; auriculars also whitish, with dusky borders noticeable anteriorly and broad and conspicuous on the upper border where they form a dark postocular stripe; chin whitish; throat whitish with obsolete dusky tips anteriorly, becoming more prominent posteriorly; breast with dark borders still more prominent giving a decidedly squamate appearance, with central, whitish areas broad and rounded terminally; sides similar but with the pale central areas a little narrower and the external margins broader, a little warmer than Brownish Olive; belly buffy brown with whitish shaft-stripes (narrower than those of breast) rather distinctly outlined with dusky; flanks near Saccardo's Umber, streaked like the belly on the upper portion but with streaks obsolete on the lower portion; under tail-coverts near Brussels Brown, with basal feathers prominently striped, longer ones not striped. Wings rufous; outer margins of outer remiges and outer coverts darker and duller; tertials and lesser coverts brighter; tips of primaries and secondaries (including terminal three-fourths of outermost primary) dusky, not sharply defined from rufous portions; under wing-coverts Pinkish Buff  $\times$  Light Pinkish Cinnamon; tail near Chestnut. Bill (in dried skin) pale horn-color, somewhat yellowish at base of mandible, dusky at base of maxilla. Wing, 25 mm.; tail, 74; exposed culmen, 26; culmen from base, 29; tarsus, 20.

REMARKS.—Females not clearly distinguishable from the males.

Two birds from the "Upper Orinoco" (presumably well above Maipures) may be referred to *duidae* without hesitation. A female from Munduapo is not quite so clearly marked and yet has many of the characteristics of this form. A male and a female from Ciudad Bolívar and a female from Agua Salada de Ciudad Bolívar are rather distinct, and appear to be intermediate between *picus* and *picirostris* which latter reaches the Orinoco in the vicinity of Caicara, above Ciudad Bolívar. These three birds have the whitish marks of the breast and hind neck distinctly rhomboid in shape, broader than in *picus* but not so broad as in

*picrostris*, while the lower throat and upper breast are distinctly margined with dusky, not pure white. The general color of the under parts is much more grayish in tone than true *picus*. Birds from farther down the Orinoco, at Las Barrancas and Sacupana, are rather closer to *picus* but show some of the characteristics mentioned for the skins from Ciudad Bolívar. Without a larger series from the lower Orinoco I hesitate to do more than suggest the strong possibility of the intergradation of *picus* and *picrostris* somewhere between Ciudad Bolívar and Caicara.

Two males from Villavicencio, at the eastern base of the eastern Andes of Colombia, are of uncertain identity. One is inseparable from *picus*; the other is more warmly rufescent but does not markedly suggest *peruvianus*. Possibly they bear some relation to *saturation*, which I have not seen.

Birds from Bahia and nearby portions of eastern Brazil may be separable under the characters given by Bangs and Penard for "*Dendroplex picus bahiae*." Our specimens are rather definitely paler in color than *picus* and have the spots on the top of the head and the upper mantle larger and more prominent. The full investigation of this matter and of the question of the application of the name *chrysolopus* I leave for Mrs. Naumburg's studies of the birds of that region.

Certain examples from the middle course of the Amazon, on both sides of that stream, stand out from the extensive series of the *picus* group so distinctly that the existence of an unsuspected new species becomes apparent. It may be known as follows.

#### ***Dendroplex necopinus*, new species**

TYPE from Muirapinima, Rio Negro (right bank), Brazil. No. 312,106, American Museum of Natural History. Adult male collected October 19, 1929, by the Olalla brothers.

DIAGNOSIS.—Similar to *Dendroplex picus picus* of the Guianas and the lower Amazonian region of Brazil but with the pattern somewhat altered. Mantle duller and more brownish, less rufescent; pale centers of pectoral feathers more elongate, reaching almost or quite to the tips of the webs; dark margins on throat and malar region lateral but not terminal, the effect being that of ovate streaking instead of squamate spotting; lesser upper wing-coverts brown, not rufous; dusky tips of primaries and secondaries blacker and usually more sharply defined; wings averaging longer; remiges averaging more acute; bill averaging more slender when viewed from the side; tail usually longer, both actually and in proportion to the wing.

RANGE.—Both banks of the middle Amazon and the adjacent portions of its tributaries, on the right bank of the lower Rio Negro and the Jamundá, and from the left bank of the Madeira to Villa Bella Imperatriz, west of the Tapajoz.

DESCRIPTION OF TYPE.—Top of the head grayish brown with a narrow blackish terminal band and a subterminal spot of light buff on each on the feathers; hind neck lighter brown, with the pale centers of the various feathers less sharply defined; mantle Argus Brown  $\times$  Brussels Brown, anteriorly with broad buffy shaft-stripes, not distinctly outlined with dusky brown; these stripes progressively narrower posteriad and obsolete on lower mantle; rump and upper tail-coverts light Chestnut  $\times$  Bay. Lores whitish; a narrow whitish superciliary line, broadest over the auriculars and with the component feathers edged with dusky brown; malar region and auriculars whitish with the lateral margins of the feathers blackish; chin whitish; throat whitish with a light buffy tinge and with the lateral margins of the feathers narrowly blackish, broadest on the sides of the throat where they form a thin blackish line adjacent to the malar region; breast with light buff centers somewhat sagittate in shape, bordered laterally by blackish lines not surrounding the tips except toward the sides of the breast, but carried well toward the bases of the feathers where they approach the shafts; sides of breast with the tips of the central stripes more rounded and not reaching the tips of the feathers, which have the tips and margins Cinnamon-Brown  $\times$  Dresden Brown; lower breast with the dusky outlines of the shaft-stripes much reduced or obsolete, with the margins of the feathers Cinnamon-Brown  $\times$  Saccardo's Umber; belly Tawny Olive  $\times$  Sayal Brown, with ill-defined whitish shaft-streaks; flanks darker and warmer, near Brussels Brown, with streaks less distinct or absent; under tail-coverts Brussels Brown with strong buffy shaft-streaks. Wings externally Chestnut with outer margins of outer primaries sooty; tips of primaries and secondaries sooty blackish (up to terminal two-thirds of outermost primary), rather clearly, though not sharply, defined from the rufous basal portion; upper wing-coverts duller and browner, lesser series no brighter than the back; under wing-coverts Light Ochraceous-Buff with a tinge of cinnamon; feathers along radial margin of wing with brownish margins and buffy shafts; axillars slightly duller than the under wing-coverts and with darker brown speckles on the outer webs; primary-coverts slightly more cinnamonaceous; tail near Bay. Bill (in dried skin) whitish, with base of maxilla dusky; feet dull brownish slate. Wing, 115 mm.; tail, 95; exposed culmen, 26.25; culmen from base, 30; tarsus, 22.

REMARKS.—Female like the male, but smaller. Worn examples which have the tips of the feathers abraded are even more positively striped than the type. There is some variation in the exact tone of coloration, and the top of the head is frequently decidedly grayish with larger and whiter spots than in the type, though skins so marked are rather abraded. Worn skins also show a relatively prominent touch of brighter rufescence on the belly than is noticeable in the fresher skins, showing some contrast to the hue of the breast that is not apparent in the forms of *D. picus*. This is apparent also in young birds, which have the same relative characteristics as the adults though their general coloration is duller and less sharply marked.

The series of *neopinus* shows the following measurements. Males: wing, 101–115; tail, 86–95; culmen from base, 27–32.5; tarsus, 21–22.

Females: wing, 97-107.5; tail, 82-96; culmen from base, 28-30.5; tarsus, 20.25-22.

The existence of this bird has been unsuspected and further study probably will show that it has been confused with *D. p. picus* at various times in the past. Although its characters appear to be slight and are difficult to describe, it is relatively easy to recognize once its features are in mind. There are several taxonomic details that are not positive enough to be perfectly diagnostic, since they occur in some degree in occasional examples of the *picus* group; nevertheless, they are useful as contributory evidence. The primaries, in addition to being longer, and somewhat more narrowly acute at the tips, are inclined to be rather straighter; the line of the gonys from its angle to the tip is virtually straight, lacking the decided convexity of the average member of the *picus* group, though some slender-billed examples of the latter show it also. The rufous color of the uropygium averages deeper rufous than in the *picus* group.

Nothing is known as to possible differences in habitat for *necopinus* and *picus*. The latter is said to inhabit both inundated forest and the drier campos<sup>1</sup> in the lower Amazonian region. It is possible that both species are included in this account and that each is restricted to one or the other habitat, but future study in the field must determine the point. Outside of the range given, there is no indication of the characters of *necopinus* in any of the material examined, though there are many specimens of the *picus* group from other regions.

I originally had some misgivings that the name *kienerii* might be applicable to the form here described as *necopinus*. The measurements of the type of *kienerii* from Ega (=Teffé), Brazil, and a second male (=peruvianus) from Sarayacu, Perú, as given by Ménégau and Hellmayr (1906, Bull. Soc. Hist. Nat. d'Autun, XIX, p. 108), show the wings to be 110 and 114 mm. respectively, and the tails, 101 and 102. These measurements are exceptionally large for the members of the *picus* group and though some examples of *necopinus* have the wings equally long, the tails are shorter than in these two birds. The difference is notable although it may have its origin in the preparation of the specimens, since the two birds in the Paris Museum are mounted and my own series are not.

However, Dr. Herbert Friedmann has kindly examined the type and the Sarayacu specimen for me, after seeing my series, and he reports that both have the shoulder rufous and the pectoral feathers tipped with

<sup>1</sup>E. Snethlage, 1913, Jour. für Orn., LXXI, p. 527.

black. These characters leave no doubt that the name *kienerii* may safely remain with the *picus* group.

Mr. Berlioz of the Paris Museum has expressed doubts (in litt.) of the constancy of the differences that I ascribe to *necopinus* and the *picus* group, suggesting that they may be due to season, age, or condition of wear. However, this objection is met by the fact that the twenty-nine skins of *necopinus* represent every month but March, June, and September, while, in the series of *picus*, ninety-seven skins from the same general localities cover these months also. Both juvenal and adult plumages are found in both series and are as distinctive as the adults, and all conditions of wear are present for careful comparison. Consequently, the differences exhibited are not to be attributed to these causes but seem to show a genuine distinction of two specific groups.

None of the Teffé birds at hand can be referred to *necopinus*, and I have no assurance that this species occurs there or in Perú. I believe the name *kienerii*, therefore, is applicable to the form of *picus* to which it has been applied by recent authors.

The extreme development of the slender, straight, or lightly curved bill in this form approaches some *Xiphorhynchus* so closely that the distinction of the genus *Dendroplex* comes into serious question. In any case it remains rather poorly defined.

#### SPECIMENS EXAMINED

*D. p. picus*.—FRENCH GUIANA: Approuague, 1 ♀; Cayenne, 1 ♂, 1 (?). DUTCH GUIANA: Paramaribo, 1 ♂, 1 ♀. BRITISH GUIANA: 1 (?). BRAZIL: Faro, 6 ♂, 5 ♀, 1 (?); Rio Negro, Igarapé Cacao Pereira, 15 ♂, 11 ♀; Muirapinima, 2 ♂, 1 (?), Rio Tocantins, Mocajuba, 2 ♂, 2 ♀; Baião, 2 ♂, 2 (?); Rio Xingú, Tapará, 2 ♂, 1 ♀; Villarinho do Monte, 2 ♂, 1 ♀; Porto de Moz, 1 ♀, 1 (?); Rio Amazonas, Villa Bella Imperatriz, 10 ♂, 9 ♀, 2 (?); Rio Tapajoz, Igarapé Brabo, 5 ♂; Santarem, 2 (?), 1 ♀; Ilha de Goyana, 1 ♀; Aramanay, 5 ♂, 2 ♀, 1 (?); Rio Madeira, Borba, 4 ♂, 3 ♀; Igarapé Auará, 1 ♂, 4 ♀; Porto Velho, 1 ♂ (?); "Lower Solimões," 1 ♂; Rosarinho, 11 ♂, 4 ♀; Santo Antonio de Guajará, 3 ♂, 1 ♀, 1 (?). VENEZUELA: Río Orinoco, Sacupana, 1 ♀; Las Barrancas, 1 ♀.

*D. p. kienerii*.—BRAZIL: Teffé, 6 ♂, 4 ♀.

*D. p. peruvianus*.—PERÚ: Sarayacu, 1 ♂; Santa Rosa, upper Ucayali, 7 ♂ (incl. type), 1 ♀.

*D. p. duidae*.—VENEZUELA: Mt. Duida, Caño León, 1 ♂ (type); Savana Grande, 1 ♂; Valle de Los Monos, 1 ♂, 1 ♀; Esmeralda, 3 ♀; "Upper Orinoco," 1 ♀, 1 (?); Munduapo, 1 ♀ (not typical). BRAZIL: Rio Negro, Tabocal, 3 ♂, 3 ♀.

*D. p. picus* × *duidae*.—BRAZIL: Rio Negro, Manaos, 2 ♂, 2 ♀; Santa Isabel, 1 ♀.

*D. p. picus* × *picrostris*.—VENEZUELA: Río Orinoco, Ciudad Bolívar, 1 ♂, 1 ♀; Agua Salada de Ciudad Bolívar, 1 ♀.

*D. p. subspecies* (?).—COLOMBIA: Villavicencio, 2 ♂.

*D. p.* subspecies (?).—BRAZIL: Descalvados, 1 ♂, 1 ♀; Tapirapoan, 1 ♂, 1 ♀, 1 (?); Utiarity, 1 ♀. BOLIVIA: Todos Santos, 1 (?).

*D. necopinus*.—BRAZIL: Rio Amazonas, Villa Bella Imperatriz, 3 ♂, 4 ♀; Rio Madeira, Borba, 2 ♂; Igarapé Auará, 1 ♂; Rosarinho, 1 ♀; Santo Antonio de Guajará, 4 ♂; Rio Negro, Muirapinima, 2 ♂ (incl. type), 1 ♀; Igarapé Cacao Pereira, 5 ♂, 3 ♀; Rio Jamundá, Faro, 1 ♂, 2 ♀.

***Lepidocolaptes lacrymiger carabayae* Hellmayr**

*Lepidocolaptes lacrymiger carabayae* HELLMAYR, 1920 (November), Arch. Naturg., LXXXV, A, Heft 10, p. 81—Chuhuasi (= Uruhuasi ?), near Ollachea, Sierra de Carabaya, Perú; ♂; Munich Mus.

I have no topotypical material of this form, but eight skins from the Junín region agree in detail with a specimen from the Urubamba Valley which has been examined by the author of the subspecies and identified by him as *carabayae*. These specimens agree also with the original description in almost all details. However, the bill is not quite so whitish as in *bolivianus* though with a definite whitish area on the maxilla that is not present in *warscewiczii*. The pale stripes of the under parts are noticeably narrower than in *warscewiczii* and the general color of the under parts is more tinged with olive, but the upper parts are much the same in both forms with the average (and dark extreme) of *carabayae* darker than in the northern birds.

Hellmayr (1925, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 4, p. 324, footnote a) records as *warscewiczii* a bird from Maraynioc with the color of the under parts approaching *carabayae* but with the brownish bill of *warscewiczii*. Judging by the skins at hand from this same region, the bird in question must belong to *carabayae* and may owe its brown bill to remains of immaturity. A young bird from Rumicruz has a dark bill but otherwise is much like adults in color (not in texture of plumage), except that the dark margins of the pale abdominal streaks are replaced in part by series of dots, a character noted also in young *warscewiczii*.

The upper part of the mantle in the Junín and Urubamba birds is little or not at all streaked with hairlike lines, as it is in *bolivianus* and most *warscewiczii*; there is enough variation in *warscewiczii*, however, to reduce the value of this character.

Records assignable to *carabayae* are from "Chuhuasi" (probably = Uruhuasi), Idma, San Miguel Bridge, Ropaybamba, and Maraynioc.

**Lepidocolaptes lacrymiger warscewiczii** (Cabanis and Heine)

*T(hripobrotus) Warscewiczii* CABANIS AND HEINE, 1859, 'Mus. Hein.,' II, p. 39—Perú; Heine coll., Halberstadt Mus.

*Picolaptes peruvianus* TACZANOWSKI, 1882, P. Z. S. London, p. 28—Tamiapampa, Perú; ♂; (?) Warsaw Mus.

Eighteen birds from northern Perú belong to the form to which the name *warscewiczii* may well be restricted. According to Hellmayr (1925, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 4, p. 323, footnote b) the type is so foxed that its exact determination is impossible, and it may possibly be assignable to the form now known as *aequatorialis*. The exact locality is unknown and I do not have sufficient information regarding the itinerary of Warscewicz, who collected the specimen, to enable me to suggest a reasonably accurate type locality. However, the original description specifies Perú and, according to present knowledge, *aequatorialis* does not reach this country. Consequently the action of Taczanowski, in 1884, of submerging his own "*Picolaptes peruvianus*" under *warscewiczii* may be taken as definite fixation of the identity of both names.

Records belonging to this form are from Tamiapampa, Tambillo, Leimebamba, Tabaconas, Molinopampa, Chachapoyas, Levanto, and Cutervo.

**Lepidocolaptes lacrymiger aequatorialis** (Ménégaux)

*Picolaptes warscewiczii aequatorialis* MÉNÉGAUX, 1912, Rev. Franc. d'Orn., II, No. 43, p. 389—Baños, Ecuador.

Previously recorded from Perú by Chapman under the belief that Alamor, Ecuador, the locality in question, lay within the Peruvian boundary. There is every possibility that this form actually exists in the adjacent portion of Perú, since Alamor is almost on the boundary line, but there is no record to date. Chapman properly includes the Alamor records in his work on the 'Distribution of Bird-Life in Ecuador.'

The Ecuadorian series is variable, but in series may be separated from *warscewiczii* by a slightly more rufous tinge on the under parts. The upper parts are not definitely warmer in tone, except in a few extremes. Single specimens are placed with difficulty since they may be matched by birds from the range of the other form.

The single Colombian example, from Ricaurte, is warmly colored, but has the streaking on the under parts quite narrow as in *carabayae*, though the general characteristics are distinctive. More material from southwestern Colombia is desirable.

## SPECIMENS EXAMINED

*L. lacrymiger bolivianus*.—BOLIVIA: Incachaca, 4 ♂ (incl. type), 4 ♀; Locotal, 1 ♂, 2 ♀; Miguelita, 1 ♂, 1 ♀; Yungas, 18° S. lat., 1 (?).

*L. l. carabayae*.—PERÚ: Rumicruz, 2 ♂, 2 ♀; Chelpes, 5 ♀; San Miguel, foot of Machu Picchu, 1 ♀.

*L. l. warszewiczi*.—PERÚ: San Pedro, south of Chachapoyas, 3 ♂, 2 ♀, 1 (?); La Leija, north of Chachapoyas, 5 ♂, 1 ♀; Chaupe, 5 ♀; Lomo Santo, 1 ♂.

*L. l. aequatorialis*.—ECUADOR: Alamor, 1 ♂, 1 ♀; Celica, 1 ♂; Zaruma, 1 ♂; Salvias, 1 ♂; San Bartolo, 2 ♀; Gualca, 2 ♂; Guachanamá, 1 ♂, 1 ♀; Papallacta, 1 ♀; Mindo, 1 ♂, 1 ♀; El Chiral, 5 ♂; Oyacachi, 1 ♂, 1 ♀; below Oyacachi, 1 ♂; upper Sumaco, 1 ♂, 1 ♀; Baeza, 3 ♂, 1 ♀; above Baeza, 1 ♂, 1 ♀. COLOMBIA: Ricaurte, 1 ♂.

***Lepidocolaptes albolineatus fuscicapillus* (Pelzeln)**

*Picolaptes fuscicapillus* PELZELN, 1868, 'Orn. Bras.,' I, p. 63—Engenho do Capitao Gama; cotypes in Vienna Mus.

*Picolaptes oblectus* ALLEN, 1889, Bull. Amer. Mus. Nat. Hist., II, p. 94—no locality given; Mus. Comp. Zool., Cambridge.

I have no topotypical material, but can see little significance in the differences observable in a small number of specimens from various localities in Bolivia, Perú, and Ecuador.

The brightest example is a male from Todos Santos, Bolivia. A somewhat more worn female from Astillero, southeastern Perú, shows a paler coloration that is certainly, in part, due to fading. A female example from Tulumayo, Junín, is a little less warmly colored beneath than the two skins mentioned. Another female, from the Río Chinchipe, is slightly darker below and a little more narrowly striped. Two females from the Río Suno, Ecuador, are not unlike the Peruvian birds except that they are smaller. One shows some grayish tips on the feathers of the mantle, and both have the top of the head with remains of the juvenal plumage, spotted finely with whitish on a somewhat grayish ground.

Hellmayr (1908, Verh. Orn. Ges. Bay., XI (1), p. 161) has compared southeast-Peruvian examples with the three cotypes of *fuscicapillus* and found them very little different. The Peruvian birds were a little larger and had the top of the head somewhat duller than the back with a noticeable postocular streak of whitish, whereas the Brazilian cotypes had the top of the head as warmly colored as the back without a postocular streak. In the six birds now at hand, the top of the head is a little duller than the back, though the difference is not sharply marked. Pelzeln's original description and the name he gave to the form in question indicate some such difference in color in the cotypes, though age may have dis-



colored the skins and made the head and back more uniform, as noted by Hellmayr. The postocular (or supra-auricular) streak is present in all six of the birds before me, though my notes indicate its absence in a male from Río Colorado, Chanchamayo Valley, in Field Museum of Natural History. The two females from eastern Ecuador are smaller than the co-types, but the Bolivian and Peruvian birds vary in both directions.

In any case, the series as a whole forms a distinct unit, variable in itself, but showing the same characteristic of brighter coloration as a criterion of separation from the other members of the group. Hence it is best left undivided, at least until a sufficient series is available from more numerous localities to show the value of such variable characters as may now be seen.

The pattern of the head in juvenal plumage bears a strong resemblance to that of *albolineatus* of the Guianas, as I have noted above, and is shown even more strongly by young birds of other forms in the group. When this feature is eliminated, the remaining differences between *albolineatus* and the *fuscicapillus* group are so slight that specific separation becomes questionable. A wider blackish submalar line, a darker bill, and a throat tinged with buff while the pectoral streaks remain white are all that separate examples of *albolineatus* from certain members of the *fuscicapillus* group, particularly those from the upper Rio Negro belonging to a new form to be described below. Hence I have treated the two groups as one, under the older name, *albolineatus*.

Records of *fuscicapillus* from Perú, not shown by material examined, are from Río Cosireni, Chaquimayo, and Borgoña.

***Lepidocolaptes fuscicapillus madeirae* (Chapman)**

*Thripobrotus layardi madeirae* CHAPMAN, 1919, Proc. Biol. Soc. Wash., XXXII, p. 261—Porto Velho, Rio Madeira, Brazil; ♂; American Mus. Nat. Hist.

The type of this subspecies differs somewhat from a number of birds taken on the left bank of the Tapajoz, being slightly more warmly colored and more narrowly streaked on the under parts. A second male from the type locality is rather closer to the Tapajoz birds than to the type, indicating the variability of this character.

Our only skin from the right bank of the Tapajoz (Aramanay) belongs to *layardi* of the Pará region, agreeing well with two skins from near Pará and one from the Tocantins. A specimen from Diamantina, near Santarem, also east of the Tapajoz, apparently belongs to *madeirae*. This skin is in the U. S. National Museum, from which Dr. Friedmann writes me that there is no supra-auricular stripe present on the specimen

in question. Aramanay is a very little way upstream from Santarem but at a point where the river is much wider than at the mouth. With these two skins apparently conflicting in their evidence of distribution, the solution of the problem must await the collection of more material in the region under discussion.

Seventeen specimens from the upper right bank of the Rio Negro and the neighborhood of Mt. Duida demonstrate an unexpected extension of the specific range of this group. This series shows sufficient distinction from the known subspecies to warrant description as new, though its affinity to the other conspecies is unquestionable. It may be known as follows.

***Lepidocolaptes albolineatus duidae*, new subspecies**

TYPE from "Campamento del Medio," Mt. Duida, Venezuela; altitude 350 feet. No. 274,044, American Museum of Natural History. Adult male collected January 19, 1929, by the Olalla brothers.

DIAGNOSIS.—Similar to *L. a. madeirae* of the Rio Madeira-Tapajoz region, but general color darker; back more deeply rufescent; pale ventral streaks averaging narrower; bill darker brown; a slight supra-auricular line of whitish (finer than in *L. a. layardi*); rufous color of wings and tail darker.

RANGE.—Lower elevations of Mt. Duida, Venezuela. and the right bank of the upper Rio Negro, Brazil.

DESCRIPTION OF TYPE.—Top of head grayish olive-brown with faint suggestions of dusky terminal margins and light shafts; mantle dark Brussels Brown; sides of neck similar, tinged with grayish; rump and upper tail-coverts Burnt Sienna X Auburn. Lores a little lighter than crown; auriculars largely sooty brown with some pale shaft-streaks at base; above the auriculars a very narrow line of whitish or buffy white, not very conspicuous; chin soiled whitish; upper throat similar with dusky margins; remainder of throat and malar region with the dusky borders submarginal, the margins more brownish; breast, sides, and flanks definitely striped, with relatively narrow whitish (Pale Olive-Buff) shaft-stripes, conspicuously outlined with sooty black, and broadly margined with Light Brownish Olive, all marks reaching the tips of the feathers; under tail-coverts similarly striped but the margins of the feathers are near Buckthorn Brown; middle of belly with dark outlines of shaft-stripes less distinct and margins of the feathers paler, grayish buff. Wings bright Auburn on exposed outer margins; a dusky area embracing all but the outer margins and a basal portion of the inner web of the outermost primary; dusky area less extended based on remaining remiges and not quite reaching the tips of the feathers on the seventh (from outside) and succeeding primaries and becoming obsolete on the inner secondaries; upper wing-coverts rufescent with distinct, buffy gray exterior margins and tips on the greater series, less conspicuous on median series, more olivaceous on primary series, and obsolete on lesser series; under wing-coverts bright Ochraceous-Tawny except along carpal margin, which is buffy with dusky spots; axillars ochraceous tawny with dusky marginal spots. Tail light Auburn. Maxilla (in dried skin) dark brown; mandible dull yellowish; feet dull blackish brown. Wing, 92 mm.; tail 77; exposed culmen, 27; culmen from base, 31; tarsus, 18.

REMARKS.—Females similar but somewhat smaller. Wing, 85–88.5 mm.; tail, 69–73; exposed culmen, 24–25; culmen from base, 29–30.12; tarsus, 17–18.5.

Males measure: wing, 90–94 mm.; tail, 74–82.5; exposed culmen, 24–27; culmen from base, 28–31; tarsus, 17.75–18.5.

A young male from Playa del Río Base, Mt. Duida, December 4, 1928, is darker brown on the back than the adults, with traces of pale hair-streaks; the top of the head is decidedly grayish, with dusky terminal margins and distinctly rhomboid central spots of pale buffy white, closely similar to the marks in adult *albolineatus*. The under parts are striped somewhat as in adult *duidae*, but the dusky outlines enclose the pale central stripes which are rather purely white and rounded at their tips, not reaching the tips of the feathers; greater and median upper wing-coverts with a short, subterminal, dusky streak.

A male from Tatú, Rio Negro, is unusually finely streaked beneath and approaches *albolineatus*. Other specimens from this and other localities vary somewhat in the breadth of the streaks. Occasionally the streaks are as broad as in the narrower-striped examples of *madeirae* but never as broad as in the extremes of the latter form. Some Rio Negro examples are a little grayer and less olive on the underparts than the Mt. Duida birds, and one from Yucabi, which is in worn plumage, tends to approach Tapajoz skins of *madeirae* in this respect.

In the ranges of the different subspecies remain many gaps that can be closed only by future collecting. In the case of *duidae*, the connection between Mt. Duida and the Rio Negro still remains to be demonstrated.

#### SPECIMENS EXAMINED

*L. a. albolineatus*.—BRITISH GUIANA: Tumatumari, 1 ♂; Rockstone, 1 ♂, 2 ♀.

*L. a. duidae*.—VENEZUELA: Mt. Duida, "Campamento del Medio," 1 ♂ (type), 1 ♀; Playa del Río Base, 2 ♂, 2 ♀; Pte del Cerro, 1 ♂, 3 ♀. BRAZIL: Rio Negro, Tatú, 3 ♂; Yucabi, 2 ♂, 1 ♀; Mt. Curucuryari, 1 ♂.

*L. a. layardi*.—BRAZIL: Utinga, near Pará, 1 ♂, 1 ♀; Tury-assú, Maranhão, 1 ♂<sup>1</sup>, 1 ♀<sup>1</sup>; Rio Tocantins, Mocajuba, 1 ♂; Rio Tapajoz (right bank), Aramanay, 1 ♂.

*L. a. madeirae*.—BRAZIL: Rio Madeira, Porto Velho, 2 ♂ (incl. type), 1 ♂<sup>1</sup>; Barão Melgaço, 1 ♀; Rio Tapajoz (left bank), Igarapé Brabo, 1 ♂, 2 ♀, 1 (?) ; Igarapé Amorin, 3 ♂, 2 ♀.

*L. a. fuscicapillus*.—BOLIVIA: Todos Santos, 1 ♂. PERÚ: Astillero, 1 ♀; Tulumayo, 1 ♀; Río Colorado, Chanchamayo Valley, 1 ♂<sup>1</sup>; Huarandosa, Río Chinchipe, 1 ♀. ECUADOR: Río Suno, above Avila, 1 ♀; lower Río Suno, 1 ♀.

<sup>1</sup>Specimens in Field Museum of Natural History, Chicago.





# AMERICAN MUSEUM NOVITATES

Number 754

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

Nov. 17, 1934

56.9, 735T (1183: 79.1)

## A NEW SPECIES OF ANTILOCAPRINE, *TETRAMERYX* *ONUSROSAGRIS*, FROM A PLEISTOCENE CAVE DEPOSIT IN SOUTHERN ARIZONA

BY QUENTIN ROOSEVELT AND J. W. BURDEN

The present brief notice preliminarily describes a new Antilocaprine from a Pleistocene cave deposit in southern Arizona. The remains were discovered and collected the past summer by the joint authors. Detached limb bones point to the new pronghorn approximating the modern species in general body proportions. The outstanding character of the fossil is its symmetrically forked horn-cores of circular cross section that replace the simple, unforked and laterally flattened cores of *Antilocapra*. It is presumed that the Arizona cores were provided with a deciduous sheath somewhat as in the manner of the recent pronghorn.<sup>1</sup> The horn-cores, while notably larger and more branching, are in their general situation and form very much as those of *Tetrameryx conklingi* Stock of the Pleistocene of New Mexico. The orbit is fully as prominent and the bullae as large as in the modern species of *Antilocapra*. The new material includes major portions of two skulls with horn-cores and teeth, several detached cores, a mandibular ramus, and a series of skeletal elements as listed below. Hazel de Berard's drawing in the adjoining figure of the more typical of the crania obviates the need of more detailed description at the present time. The material has been carefully freed from the matrix and assembled by Albert Thomson of the Museum's preparation staff.

Because of the fascination always attendant on cave exploration and the general lack of work in this field in North America, an account of the present discovery may be of interest. The entrance, about three feet in breadth and one and one-half in height, was quite a squeeze. As the particular cavern had a reputation for caving in, we had to be on our guard as we crawled through the narrow tunnels or investigated with candles the smaller nooks and crannies. We encountered the first sign of fossils, a small bone projecting from the ceiling, on our way out of the cave on the first day. The explored part of the cave consists mainly of a large cavern 30-50 feet high, of grayish limestone, into which open

---

<sup>1</sup>Roosevelt, Theodore, and Others, 1902, 'The Deer Family,' p. 98.

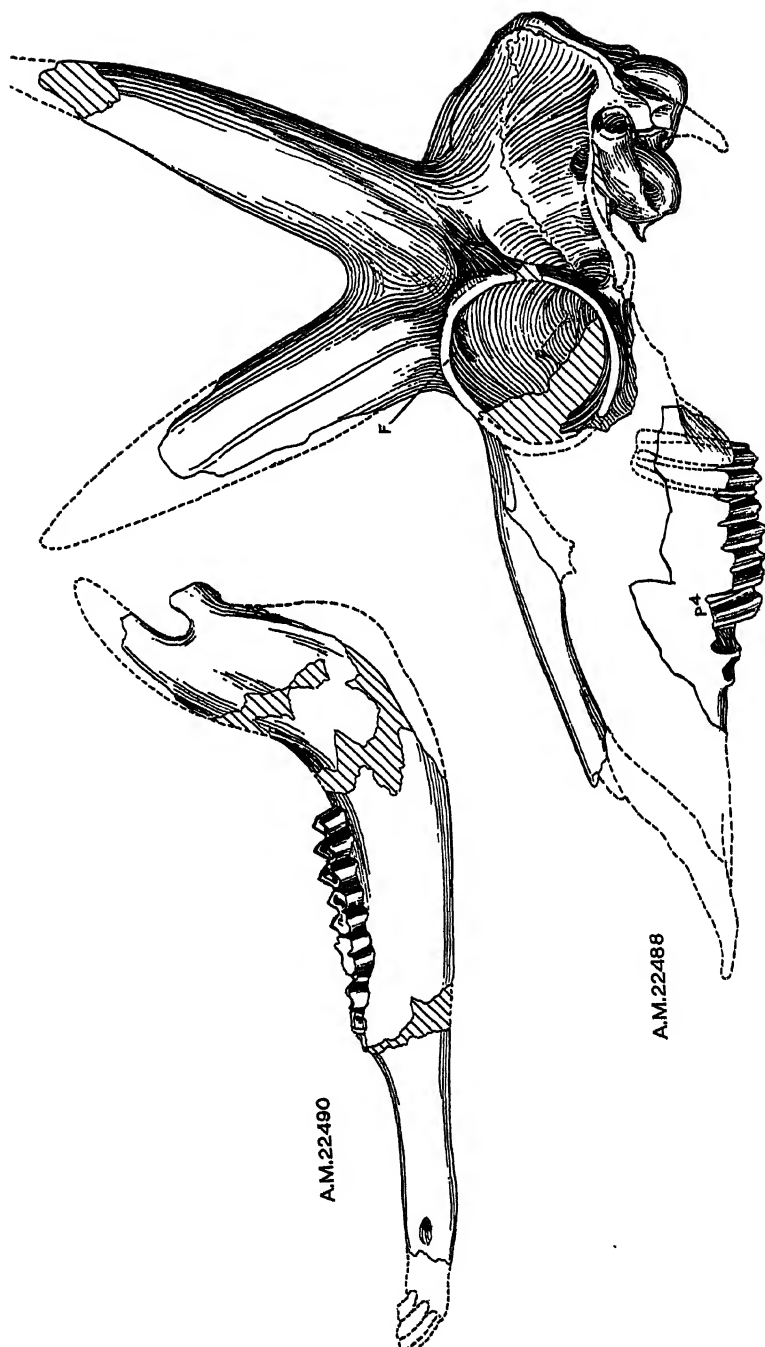


Fig. 1. A.M. 22488 and 22490, *Tetrameryx onusrosagris*, n. sp., type and ref., from a Pleistocene cave deposit in southern Arizona.  
Lateral views of skull and ramus  $\times 14$ . F, supra-orbital foramen.

two entrances and the mouth of a long tunnel. It was at the mouth of this tunnel that the second specimens were found, and it was here that we first commenced operations and secured the only mandibular ramus. Later at the spot where we had first noticed the bone in the ceiling, we worked for three days with the result that we uncovered two skulls, a pelvis, some vertebrae, and numerous limb bones. The fossils were embedded in rubble, which consisted largely of limestone fragments and hardened clay. The floor of the cave to great depth was made up of rich dark earth permeated with fragments of rock. Some distance down the passage there were stalactites of many sizes and shapes, and signs of water erosion. In the main room we found a piece of pottery and a bone crackled by fire.

## MEASUREMENTS

	<i>T. onusrosagris</i> , n. sp.		<i>T. conklingi</i> Stock	<i>Antilocapra</i> <i>americana</i> Ord
	A.M. 22488	A.M. 22489	(After Stock, 1930)	A.M. 75243, ♂
Horn-cores, fore and aft diameter of base.	60.3 mm.	58. mm.	40.5 mm.	38. mm.
Height fork from notch	103.	104.	50. <sup>1</sup>	
Height tip above orbit.	((145.))	(140.)	61. <sup>1</sup>	142.
p <sup>2</sup> -m <sup>3</sup> incl.....	64.8			73.
m <sup>3</sup> .....	15.2×8.7	17.2×8.9		15×9.5
	A.M. 22490			
p <sub>2</sub> (alv.)-p <sub>4</sub> incl.....	20.7			29.
m <sub>1</sub> -m <sub>3</sub> incl.....	45.			50.5
p <sub>2</sub> (alv.)-m <sub>3</sub> incl.....	65.2		54.5	79.5
	A.M. 22483 Of Different Individuals			
Greatest length:				
Radius.....	193.		156.	210.
Metacarpus.....	198.		153.6	209.5
Tibia.....	276.			267.
Metatarsus.....	207.		165.9	219.5

( ) approximate; (( )) estimated.

<sup>1</sup>From cast.



**Tetrameryx onusrosagris**, new species

## Figure 1

TYPE.—Skull with horn-cores,  $p^2$ - $p^3$  alveoli, and moderately worn  $p^4$ - $m^3$ . A.M. 22488 Figured this paper, *Fig. 1*.

Maxillae displaced and broken,  
premaxilla missing.

## REFERRED.—

Partial skull with right horn-core and  $m^1$ - $m^2$ . A.M. 22489

Fragment of posterior basal area of skull. A.M. 22484

Five detached horn-cores. A.M. 22484

Left ramus with  $p_2$  alveolus - $m_3$ . A.M. 22490 Figured this paper, *Fig. 1*.  
Premolars broken.

Four fragments of rami. A.M. 22484

Skeletal elements of several individuals, including: A.M. 22483

Three fragments of scapulae.

Four partial humeri, two distal and two proximal ends.

One ulno-radius (broken), distal half of second, and top of ulna.

Metacarpus.

Right and left femora, proximal ends missing, eight fragments.

Tibia.

Metatarsus and distal end of second.

Astragalus.

Two 1st, three broken 1st, two 2d, and one 3d phalanges

Pelvis.

Sacrum.

Sternum fragment.

Three cervicals (including atlas).

Five lumbar and two fragments.

One dorsal and two fragments.

One rib and four fragments.

Miscellaneous fragments including two distal ends of metapodials.

# AMERICAN MUSEUM NOVITATES

Number 755

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

Nov. 17, 1934

59.7, 58 (95)

## TWO NEW FRESH-WATER FISHES (PERCESOCES) FROM NEW GUINEA

By J. T. NICHOLS AND H. C. RAVEN

Among some fresh-water fishes collected for The American Museum of Natural History in southern New Guinea in 1933-1934, by Richard Archbold, L. J. Brass, and A. L. Rand, are an apparently undescribed species of the melanotaeniid genus *Rhombatractus*, and another belonging to the atherinid genus *C-aterocephalus*.

### *Rhombatractus archboldi*, new species

DESCRIPTION OF TYPE.—No. 12475, American Museum of Natural History: a male, collected Jan. to Feb., 1934, at Wuroi (Oriomo River), British Papua, by Archbold, Brass, and Rand. The river, bordered with forest, here runs through dry savanna, some 20 miles from the coast (twice as far by river) with quite fresh water though well within tidal influence, and the fish collected were mostly taken from small affluent streams.

Length to base of caudal, 76.5 mm. Depth in this length, 2.5; head, 3.5. Eye in head, 3.3; snout, 3.3; interorbital, 3.1; maxillary, 3; greatest width of body (at back of head), 2.2; depth of peduncle, 2.7; its length, 2; pectoral, 1.4 (slightly longer than head without snout); ventral (with filamentous tip), 1.5; spines of first dorsal, 2.1; its longest ray (filamentous), 1.5; spine of second dorsal, 2.7; its longest ray, 2; spine of anal, 3; its longest ray, 2; caudal lobe, 1.2.

Dorsal, I, 4—I, 10; anal, I, 19. Scales, 36; about 16 before dorsal; 2 rows on cheek below eye.

Profile concave and back somewhat elevated; lower outline of body deeply convex; breast, and whole body behind the first dorsal strongly compressed. Interorbital flat; mouth oblique, the jaws about equal; maxillary to under front margin of eye; front aspect of mandible concave. Spines of first dorsal and of anal opposed; caudal moderately forked. Scales on body mostly with slightly fluted edges.

Color pale, darker above; a bold black lateral band about as wide as pupil, through eye to base of caudal; fins, except pectorals, tinged with purplish red.

The paratypes number 22: 14 males, smaller than the type, down to 35 mm., and 8 females of 80 to 42 mm. standard length. Males are deeper, with lateral band bolder. Though the difference in these respects is not great and there is some variation, the eye is consistently more nearly equal to the snout and jaws more nearly equal in males.

The largest female, No. 12476, may be described as follows:

Length to base of caudal, 80 mm. Depth in this length, 3; head, 3.6. Eye in head, 3.7; snout, 3; interorbital, 2.6; maxillary, 2.75; greatest width of body (at back of

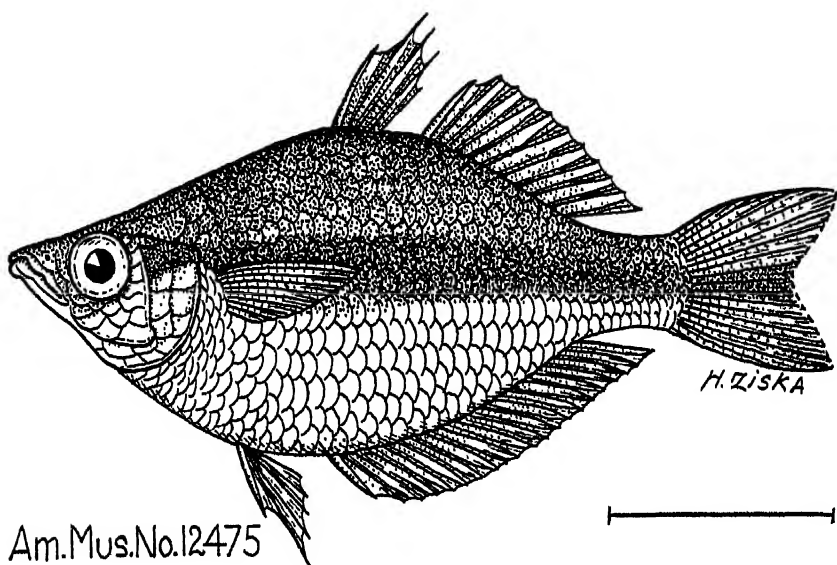


Fig. 1. *Rhombattractus archboldi*, type, male.

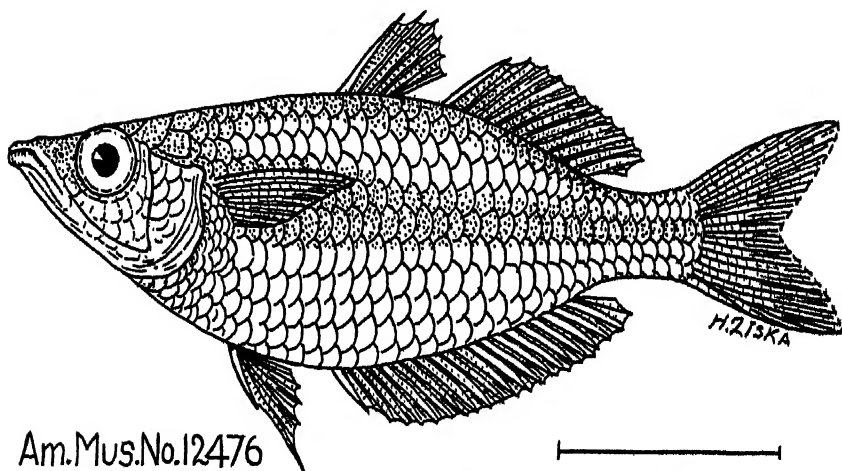


Fig. 2. *Rhombattractus archboldi*, paratype, female.

head), 2.2; depth of peduncle, 3; its length, 2.2; pectoral, 1.5 (very slightly longer than head without snout); ventral (with filamentous tip), 1.6; spine of first dorsal, 2; its longest ray, 1.8; spine of second dorsal, 2.5; its longest ray, 2.4; spine of anal, 4; its longest ray, 2.5; caudal lobe, 1.4.

Dorsal rays, 1, 5—1, 11½; anal, 20½. Scales, 32; about 15 before dorsal; 1 or 2 rows on cheek below eye.

Profile very slightly concave, the back slightly elevated, the lower outline somewhat more convex than the upper; body well compressed. Interorbital flat; lower jaw distinctly included; mouth oblique, maxillary not quite to under front margin of eye; upper outline of mandible from in front, concave. Spines of first dorsal and of anal opposed; caudal moderately forked.

Color almost uniform; top of head darker and its lower surfaces paler; an indistinct dark lateral band about as wide as pupil. Fins (except pectorals and ventrals) tinged with reddish purple, anal dusky at margin.

Five males from 55 to 76.5 mm. standard length have depth, 2.9 to 2.5; maxillary in head, 2.5 to 3, reaching to under front of eye in three and not quite so far in two of them; soft rays of second dorsal, 10½ to 12; of anal, 18 to 20; scales 34 to 36.

Five females of from 55 to 80 mm. have depth, 3.4 to 3; maxillary in head, 2.6 to 3, reaching to just past front of eye in one, to under front of eye in two, and not quite so far in two of them; soft rays of second dorsal, 10 to 11½; of anal, 17 to 20; scales 32 to 35.

The species is close to *Rhombatractus goldiei* (Macleay), of which we have a specimen for comparison received from the Amsterdam Museum, collected at Sekanto River, northern New Guinea, 74 mm. standard length. It has depth, 3.3; maxillary in head, 2.7, to just past front margin of eye; soft rays of second dorsal, 14½; of anal, 22½. There are also a number of specimens in the Archbold collection which we so identify from Kubuna, British Papua (some 275 miles east across the Gulf of Papua from the type locality of *R. archboldi*), of which five of 64 to 87 mm. standard length have depth, 3.6 to 3; maxillary in head, 2.7 to 2.8, reaching to under front margin of eye in three, and not so far back in two; soft rays of second dorsal, 12½ to 15; of anal, 22 to 27.

#### ***Craterocephalus randi*, new species**

DESCRIPTION OF TYPE.—No. 12477, American Museum of Natural History, collected in December, 1933, at Kubuna (Kubuna River), British Papua (not far northwest of Port Moresby), altitude 100 meters, by Archbold, Brass, and Rand. The river is here one of deep pools and swift riffles on the edge of heavy lowland forest.

Length to base of caudal, 55 mm. Depth in this length, 5.4; head, 4.1. Eye in head, 3.2; snout, 3.7; interorbital, 3.2; maxillary, 4; greatest width (at back of head), 2; depth of peduncle, 2.8; its length, 1; pectoral, 1.4; ventral, 1.4; longest dorsal spine, 2; longest dorsal ray, 1.7; anal ray, 1.7; caudal (broken), approximately, 1.

Dorsal rays, V—7, anal, 7. Scales, 36; before dorsal, 18 or 19.

Slender, moderately compressed, snout rather blunt. Interorbital almost flat; jaws equal, or lower jaw very slightly projecting; mouth small, maxillary reaching  $\frac{3}{8}$  to below front margin of large eye, which is well before center of head, the snout being 1.4 in postorbital distance. Origin of first dorsal equidistant from margin of opercle and the center of second dorsal base. Predorsal scales are small forward to the middle of the eye, somewhat irregular on top of the head, a large central and pair of scales in front forming a triangle over the front half of the eye.

A bold black band of approximately the same width throughout, from snout to base of caudal, separated by a pale streak from the dark back, and with two lines of spots following the scale-rows below it, the lower line broken and of smaller spots.

In all there are five specimens, of which the type is the largest. This seems to be a fragile little fish, and all have fins more or less broken, rays and scales unsatisfactory to count. The four paratypes have

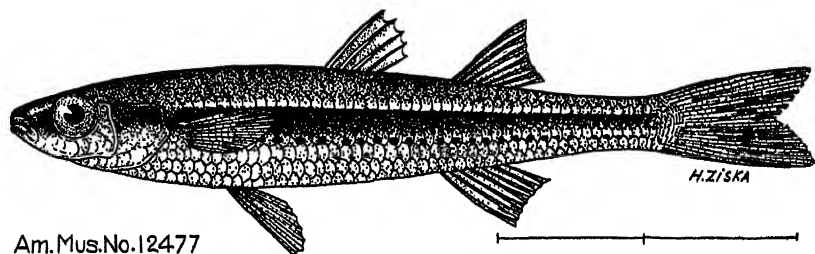


Fig. 3. *Craterocephalus randi*, type.

standard length 32.5 to 53 mm.; depth, 5.1 to 5.8; head, 3.7 to 4; eye, 2.8 to 3; dorsal rays, V to VI—7 to 8; anal, 7 to 9; scales, 36 to 37; before dorsal, 16 to 18.

Squamation on the head is quite unlike that in a larger (71 mm.) "cotype" specimen of *C. nouhuysi* Weber from the Amsterdam Museum, wherein enlarged scales begin at the nape; and the species is doubtless closer to *C. stercus-muscorum* (Günther), with specimens of which,<sup>1</sup> from North Queensland (collected by Raven), it has been compared.

One such of approximately the same size differs as follows.

Length to base of caudal, 56 mm. Head in this length, 3.8. Eye in head, 3; interorbital, 2.5; (least) depth of peduncle, 3.3; its length, 1.4; pectoral and ventral, 1.5. Dorsal rays, VII—8; anal, 9. Scales, about 34; predorsal, 15. Snout moderately pointed; lower jaw appreciably projecting; origin of first dorsal appreciably nearer margin of opercle than to origin of second dorsal.

A black band from snout to base of pectoral, continued more narrowly back as a streak to base of caudal; on the body there are two very regular rows of spots above and two below it, following the rows of scales.

<sup>1</sup>Nichols and Raven, 1932, Amer. Naturalist, LXVI, p. 192, Fig. 3.

# AMERICAN MUSEUM NOVITATES

Number 756

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

Nov. 30, 1934

50.88, 6 X (85)

## STUDIES OF PERUVIAN BIRDS. XV<sup>1</sup>

### NOTES ON THE GENUS *XIPHORHYNCHUS*

By JOHN T. ZIMMER

Dr. C. E. Hellmayr has again generously supplied me with detailed notes about certain specimens not immediately accessible, and Dr. Percy R. Lowe has been equally kind regarding certain skins in the British Museum. I am further indebted to the authorities of the Carnegie Museum, Pittsburgh; Field Museum of Natural History, Chicago; and the U. S. National Museum, Washington, for the loan of certain specimens which have aided in the following studies.

Names of colors are capitalized when direct comparison has been made with Ridgway's 'Color Standards and Color Nomenclature.'

#### *Xiphorhynchus guttatus guttatoides* (Lafresnaye)

*Nasica guttatoides* LAFRESNAYE, 1850, Rev. Mag. Zool., (2) II, p. 387—"Lorette" (=early Department of Loreto, Perú, near Pebas) and "Colombie" (=Bogotá region); the type I believe to be the Bogotá skin from Lafresnaye's collection, now in Mus. Comp. Zool., Cambridge.

*Dendroornis rostrispallens* DES MURS in CASTELNAU, 1856 (June), 'Expéd. Amér. Sud.,' pt. 7, I (3), livr. 17, Oiseaux, p. 45, Pl. XII, fig. 2—Pebas; cotypes in Paris Mus.

I have at hand an interesting series of two hundred and forty-six examples of *guttatoides* from a wide variety of localities in its extensive range and am unable to find any positive characters to warrant the recognition of any additional subspecies. The form as it stands is highly variable, and individual specimens may be selected from most of the localities which show differences of greater or less degree, but they may be matched by skins from other places and the series as a whole remains indivisible.

There is some tendency toward the pattern of *polystictus*<sup>2</sup> in the birds from the lower Rio Negro, Brazil, one or two of which come very close to that form in this respect, but the bill is consistently paler.

<sup>1</sup>Earlier papers in the series comprise American Museum Novitates Nos. 500, 509, 523, 524, 538, 545, 558, 584, 646, 647, 668, 703, 728, and 753.

<sup>2</sup>It appears necessary to substitute Salvin and Godman's earlier name for the later *sororius* of Berlepsch and Hartert. I have before me one of Whitely's skins from Bartica Grove and find such close approximation to a series of "*sororius*" from nearby parts of British Guiana and elsewhere that segregation is unwarranted. The pattern of *polystictus*, its whitish throat, its measurements, and the shape and color of its bill may be found in skins from other localities, though not all in single specimens.

Similarly there is a little approach on the upper Orinoco, but the specimens from the neighborhood of Mt. Duida are consistently true *guttatoides*.

Among the specimens from the south bank of the Amazon, I am surprised to discover one male *guttatoides* from Borba and twelve males, three females, and one bird of undetermined sex from Villa Bella Imperatríz, all from within the ostensible range of *eytoni*. Furthermore, there are a male and a female of *eytoni* from Faro, within the apparent range of *polystictus*. Nevertheless, some skins of *eytoni* and *guttatoides* are exceedingly similar in all but the color of the bill, and the latter character is not greatly distinctive in *eytoni* and *polystictus*. All three forms are so similar in general respects that it is impossible to find any definite characters that will separate *eytoni* from the other two which virtually intergrade. Fortunately, the data on the skins before me (with the exception of the Borba male) show that the examples of *eytoni* were taken in slightly different neighborhoods from those where *guttatoides* and *sororius* were obtained. At Villa Bella Imperatríz, all the skins of *eytoni* are from several collecting stations situated in the lowlands of the delta of the Rio Andirá, Rio Ramos, and Rio Limão. Those of *guttatoides*, on the other hand, are from the Serra de Parintins, on slightly higher and drier ground a little to the eastward.

Similarly, the specimens of *eytoni* from Faro are labeled simply "Faro," presumably from near the town of that name, which is at the edge of extensive deltal lowlands forming a virtual continuation of those near Villa Bella Imperatríz. The skins of *sororius*, however, are from points higher up the Rio Jamundá, so far as can be determined. There are no distinctive data on the labels of the Borba skins except that the specimen of *guttatoides* was taken on a different date from the examples of *eytoni*, probably indicating a different local area. Presumably, therefore, *eytoni* is an inhabitant of the low, inundated forest, while *guttatoides* and *polystictus* favor drier woods, though Dr. E. Snethlage (1913, Jour. für Orn., LXI, pp. 481, 489, 495) found *sororius* only in the drier woods, but *eytoni* in both the inundated and dry forest (not noted as in the same region as *sororius*). Possibly a seasonal movement may bring them together in the non-breeding season. In any case, if *eytoni* is to be maintained as a conspecies of *guttatoides* and *polystictus*, as I believe it must, its distributional lines must be drawn with the ecological aspect in view. With a single exception, there is still no overlapping of ranges when this is done, and hence no distributional conflict. The exception is a male from the upper Rio Roosevelt, "6th March Rapids,"

which is somewhat intermediate between *guttatoides* and *eytoni*. In general pattern and coloration it is indistinguishable from a female of undoubted *guttatoides* collected at Barão Melgaço, Rio Gy-Paraná, only a few miles away in apparently similar terrain, but the maxilla is blackish. The dorsal streaking is narrow, as in many other *guttatoides*, at the opposite extreme of the pattern of *eytoni* and unapproached by any examples of that form. Except for the blackish maxilla, the Rio Roosevelt bird is, therefore, like *guttatoides* and may represent a casual variation though I can not match it in the extensive series of that form from elsewhere. More skins from the upper Rio Roosevelt are needed to establish the status of this bird.

A good series of *eytoni* from the country reaching from western Maranhão to Borba shows a rather regular progression of increase in rusty tones of coloration. Hellmayr (1907, Novit. Zool., XIV, p. 366; 1910, *op. cit.*, XVII, p. 324) has already pointed out the fact that Borba birds are more suffused with rusty than most Pará skins but he records the observation of a number of Pará birds that agreed with Borba examples. These I have not seen. I have, however, one Borba bird almost as lacking in rusty tone as the Tocantins and Maranhão examples, all of which now at hand agree in lacking this coloration. Most of the Tapajoz examples have more rusty color than the Tocantins birds, but some are inseparable, and the series from the Xingú shows a still greater tendency toward typical *eytoni*. Where a definite line could be drawn to separate a rusty-toned form from *eytoni* is difficult to say, and the form is best left undivided. A slight approach toward *guttatoides* is shown by a male of *eytoni* from Borba, which has a somewhat buffy line along part of the culmen. On the other hand, the bill in *guttatoides* varies in the amount of dusky shading at the base. Sometimes the entire bill is very whitish, without much definite shading. Usually at least the region of the nostrils is dusky and often a rather more extensive area on the maxilla, but if the entire maxilla is dull grayish or brownish (it is never black as in *eytoni*) the mandible is of the same shade. As a rule, also, the bill of *eytoni* is more slender with more regular curvature of the culmen from base to tip, and with the tip less decidedly decurved than in *guttatoides*, but the variations in the latter form show every degree of intermediacy. The top of the head in *eytoni* is blacker and the lores more distinctly blackish as a rule; the streaks on the upper mantle are always broad at the base and usually distinctly acute at the tips, but there is perfect intermediacy in some skins of *guttatoides*. The throat is usually whiter, at least in typical *eytoni* and the dark outlines of the dorsal and



ventral stripes frequently sharper and blacker, but there are too many specimens of both forms so nearly alike that no reliance may be placed in these characters. The color of the bill is distinctive in young birds as well as in adults and remains the best character for the separation of the two forms.

*X. g. guttatoides* has been recorded in Perú from Monterico, La Merced, Yahuar Mayo, Pebas, Iquitos, Elvira, Yurimaguas, Nauta, Samiria, Cavallo-Cocha, and "Loreto," though if the last-named locality is based on the "Lorette" from which Lafresnaye recorded ten specimens of his *guttatoides*, it is equivalent to Pebas. Other localities are given in the subjoined list of specimens.

#### SPECIMENS EXAMINED

*X. g. guttatus*.—BRAZIL: "Bahia," 2; Cajazeiras, 6 ♂, 1 (?); Espirito Santo, Lago Juparaná, 2 ♂, 1 ♀.

*X. g. d'orbignyianus*.—BOLIVIA: Mission San Antonio, 3 ♂, 7 ♀; mouth of Río San Antonio, 2 ♂ (incl. type of "*rimarum*" Cherie), 1 ♀; Todos Santos, 2 ♂, 2 ♀. BRAZIL: Chapada, 1 ♂, 1 ♀ (?); Descalvados, 1 ♂; Tapirapoan, 1 ♂; Urucum, 1 ♀; Belvedere de Urucum, 2 ♀.

*X. g. eytoni*.—BRAZIL: Maranhão, São Luiz, 1 ♂, 1 ♀, 1 (?); As Mangueiras, 3 ♂; Tabocas, 1 ♀; Rio Tocantins, Mazagao, 1 ♂; Arumatheua, 1 ♂; Mocajuba, 2 ♂, 2 ♀; Baíão, Pedral, 1 ♂, 1 ♀; Rio Xingú, Tapará, 5 ♂, 1 ♀; Majary Recreio, 1 ♀; Porto de Moz, 2 ♂; Forte Ambé, 1 ♀; Rio Curua, Ilha Malocca, 1 ♂; Rio Tapajoz, Igarapé Brabo, 6 ♂, 4 ♀; Caxiricatuba, 2 ♂, 1 ♀; Piquiatuba, 1 ♀; Aramanay, 2 ♂, 1 ♀; Tauary, 2 ♂, 1 ♀; Rio Amazonas, Villa Bella Imperatriz (Lago Andirá), 2 ♂; (mouth of Rio Andirá), 1 ♂, 1 ♀; (Serra de Parintins), 1 (?); Rio Madeira, Borba, 5 ♂, 3 ♀; Rio Jamundá, Faro, 1 ♂, 1 ♀.

*X. g. guttatoides*.—BRAZIL: Rio Amazonas, Villa Bella Imperatriz (Santa Clara), 11 ♂, 3 ♀, 1 (?); Rio Madeira, Borba, 1 ♂; Rosarinho, 15 ♂, 4 ♀; Santo Antonio de Guajará, 3 ♂, 3 ♀; Rio Roosevelt, "6th of March Rapids," 1 ♂ (not typical); Rio Machados, Barão Melgaço, 1 ♀; Tefé, 5 ♂, 3 ♀; Rio Negro, Igarapé Cacao Pereira, 2 ♂, 2 ♀; Tabocal, 1 ♀; Mt. Curycurari, 2 ♂, 4 ♀; Yucabi, 2 ♂; Tatú, 11 ♂, 12 ♀; Camanaos, 1 ♂; São Gabriel, 2 ♂, 1 ♀. VENEZUELA: Tahuapunto, 1 ♀; Río Cassiquiare (Solano, El Mery, opposite El Mery, mouth of Río Ocamo, and opposite mouth of Río Ocamo), 41 skins; vicinity of Mt. Duida, 19 ♂, 17 ♀. COLOMBIA: "Bogotá," 1 (?); Florencia, 1 ♂. ECUADOR: Río Suno, above Avila, 1 ♂, 2 ♀; lower Río Suno, 2 ♂; below San José, 1 ♂; mouth of Río Curaray, 2 ♂, 1 ♀; "Napo," 1 (?). PERÚ: Puerto Indiana, 4 ♂, 7 ♀; Orosa, 4 ♂, 2 ♀; Río Seco, west of Moyobamba, 2 ♂, 1 ♀; Sarayacu, 9 ♂, 11 ♀; Lagarto, upper Ucayali, 4 ♂, 10 ♀; Santa Rosa, 4 ♀; mouth of Río Urubamba, 1 ♂; Astillero, 1 (?); La Pampa, 1 ♂. PERÚ or BRAZIL: "Upper Amazon," 1 (?).

*X. g. polystictus*.—BRITISH GUIANA: Bartica Grove, 1 ♀; Kamakusa, 1 ♂; Minnehaha Creek, 1 ♂, 2 ♀; Tumatumari, 1 ♂, 1 ♀. DUTCH GUIANA: near Paramaribo, 1 ♂, 1 ♀. VENEZUELA: Munduapo, 1 ♂; Maripa, 1 ♂; La Unión, 1 ♀. BRAZIL: Faro (Castanhal), 1 ♂; (San José), 1 ♂; (mouth of Río Paratucú), 3 ♂, 2 ♀; (Serra do Espelho), 2 ♀.

***Xiphorhynchus spixii juruanus* (Ihering)**

*Dendroornis ocellata juruana* IHERING, "1904" = May, 1905, Rev. Mus. Paulista, VI, p. 436—Rio Juruá, Brazil; cotypes in Mus. Paulista.

Specimens from Teffé, Brazil, from southeastern Perú, and from the lower Ucayali and the south bank of the Amazon between the Ucayali and the Javari are all relatively uniform, and a series from São Paulo de Olivença, Brazil, in the Carnegie Museum, is exactly the same. These birds agree with the description of *juruanus*, whose type locality is near the center of the area bounded by the localities from which material has been examined, and may be taken unhesitatingly to represent this form which is the palest and least conspicuously marked member of the specific group to which it belongs. Probably *juruanus* ranges eastward to the left bank of the Purús, but birds from east of this river and on both sides of the Madeira belong to *elegans*, including Pelzeln's specimen from Manaqueri.

The material at hand shows no direct intergradation between *elegans* and *juruanus*; the variations of *juruanus* are all in the direction of *insignis* of central Perú, as will be discussed below. On the other hand, the specimens of *elegans* from nearest the Amazon have the pectoral spotting slightly smaller than skins from the upper Madeira near the type locality, and this, in a way, is a trend toward *juruanus*. To the eastward, *elegans* is connected rather definitely with *spixii*, which occupies the region from the Pará district west to the right bank of the Tapajoz. Specimens from the latter region often have the stripes on the belly less distinct than in Xingú, Tocantins, and Pará specimens, and are very close to some of the most boldly marked examples of *elegans*. The rufescent tinge on the bend of the wing is variable.

On the Ucayali, in Perú, the transition which occurs between *juruanus* and *insignis* is so diffused that it is impossible to draw a distinct line between them as may be done between *juruanus* and *elegans*. On the other hand, *insignis* forms a transition between *juruanus* and an undescribed form north of the Amazon which is so similar in many respects to *elegans* that the relationship is obvious.

Thus a complete chain of related forms is established although the geographical sequence is not the genetic one.

No previous records of *juruanus* exist from Perú.

***Xiphorhynchus spixii insignis* (Hellmayr)**

*Dendroornis insignis* HELLMAYR, 1905 (Feb. 24), Bull. Brit. Orn. Club, XV, p. 55—Samiría, Perú; ♂ ad.; Berlepsch Coll., Frankfort Mus.

Birds from Sarayacu and Orosa, in Perú, and from eastward along the south bank of the Amazon in Brazil, as far as Teffé, are *juruanus*, as has been discussed on an earlier page, but in the region of the upper Ucayali a definite difference is discernible. The bill becomes largely whitish, the top of the head is blacker with larger spots, the streaks or spots on the mantle enlarge a little (though they are sometimes no larger than in *juruanus*) and, though they are frequently restricted to the upper part of the mantle, they seem never to be so nearly obsolete as they are in extreme examples of *juruanus*. The general color of the dorsal plumage is warmer than in *juruanus*, but the tone of the under side remains nearly the same with the chin and upper throat definitely whitish, with only a light tinge of buffy notably paler than the color of the lower throat and the pectoral spots; the latter average broader than in *juruanus*, and the belly is frequently a little more positively spotted than in the more eastern form, though the spots are small and are obsolete on the lower belly.

I have seen no examples from near Samiría, the type locality of *insignis*, but the original and supplementary descriptions indicate a bird much like the upper Ucayali form. Particular reference is made to the narrower, more elongate streaks restricted to the upper mantle, much as in *juruanus*, while the under parts are said to have larger and more extensive spots than in *juruanus*; the upper wing-coverts and scapulars lack all trace of the pale shaft-streaks so conspicuous in *elegans*, while the bill is whitish except at the base of the maxilla.

Taczanowski's description of Yurimaguas and Chamicuros specimens agrees well with this characterization, so far as the particular details are mentioned, and adds the fact that the gular area is less ochraceous than the chest and pectoral spots, while the lower abdomen is much paler than the anterior portion. These points are of little consequence in the matter of distinguishing *insignis* from *juruanus*, but are significant when comparing birds from north of the Amazon in Perú and eastern Ecuador. These have been referred to *insignis* but prove to be so consistently distinct that they deserve a name. Their description follows shortly.

The upper Ucayali series is not entirely uniform and shows occasional divergence in the direction of *juruanus*. Thus, out of eighteen skins from this region, three (two males from Lagarto and one from Santa

Rosa) have the maxilla without a definite whitish terminal area. The two Lagarto birds, furthermore, have the top of the head more brownish than sooty, the mantle exceptionally little streaked, and the pectoral spots notably small; the Santa Rosa bird is not marked in these respects. The characters are those of *juruanus* though in the present instance they presumably represent the extreme of individual variation in *insignis*. Sarayacu birds are all of this nature with no trace of the characters of *insignis*.

Records from Perú which belong to *insignis* are from Samiria, Yurimaguas, Chayavitas, Shanusi, and Chuchurras, to which the material examined adds several localities.

### ***Xiphorhynchus spixii ornatus*, new subspecies**

TYPE from Puerto Indiana, mouth of the Río Napo, Perú. No. 231,998, American Museum of Natural History. Adult female collected July 7, 1926, by Carlos Olalla and sons.

DIAGNOSIS.—Nearest to *X. s. elegans* of western Matto Grosso and the Rio Madeira, Brazil, but more warmly colored and with the spots of upper and under parts larger; bill whitish except on basal part of maxilla; lesser wing-coverts on radial margin of wing less strongly rufous; scapulars and upper wing-coverts usually similarly streaked with buff; wing, tail, and uropygium deeper rufous.

Differs from *insignis* by an even greater difference in the size of the dorsal and ventral spots; pectoral spots decidedly deeper ochraceous-buff; throat deep buff, not white.

RANGE.—Northeastern Perú, north of the Amazon, and the Napo region of eastern Ecuador; north to eastern Colombia and east to the neighborhood of São Paulo de Olivença, Brazil (apparently crossing to south bank of the Amazon at that point).

DESCRIPTION OF TYPE.—Top of head blackish, with large, rounded, subterminal spots of buff, and with distinct, though narrow, buff shaft-lines extending toward the bases of the feathers; hind neck similar; mantle and scapulars Brussels Brown, with very large subterminal spots of Cinnamon × Clay color, a little narrower and more elongate on lower portion but broader (3–5.5 mm. wide) on upper portion, continued basad as a shaft-line or streak sometimes 1–2 mm. wide (often making a violin-shaped area); the pale spots and the broadest shaft-stripes broadly outlined with blackish; rump and upper tail-coverts Chestnut × Bay. Lores whitish; a superciliary line of dull whitish extending to sides of neck where it is strongly tinged with ochraceous; auriculars with dull whitish shaft-stripes and dusky dorsal margins; malar region a little more buffy; chin very narrowly whitish at point; remainder of chin and throat Cinnamon-Buff with rounded tips margined with blackish, more prominently on lower portion; breast and sides with similar pale central spots, 3–4 mm. wide but more constricted basad and thus more fan-shaped, outlined (at least terminally) with blackish; lateral margins of feathers broadly dark Dresden Brown; belly and flanks warm Dresden Brown (darker on flanks) with deep Cinnamon-Buff shaft-stripes outlined with dusky, broadest anteriorly, obsolete on femoral areas which are near Cinnamon-Brown; under tail-coverts Saccardo's Umber with

broad but indistinct buffy shaft-stripes outlined with dusky. Remiges light Chestnut above (paler in ventral aspect) with dusky terminal area occupying two-thirds of the outermost primary but obsolete on the inner secondaries and tertials; outer margins of primaries tinged with olive brown; greater and median upper wing-coverts near Sepia (much more rufescent on inner ones), with traces of short, buffy shaft-streaks near tips of some of the feathers; lesser series similar, but the feathers along radial margin a little more rufescent and unmarked. Under wing-coverts buffy Pinkish-Cinnamon. Tail Bay. Bill (in dried skin) whitish on distal portion, pale slaty at base. Feet dark brown. Wing, 97 mm.; tail, 75.5; exposed culmen, 30; culmen from base, 34.5; tarsus, 22.

REMARKS.—Males like the females in color but a little larger in average size (wing, 96–104 mm. as compared with 90–98).

Although in the original description of *insignis* certain specimens from Perú north of the Amazon, eastern Ecuador, and Bogotá were referred to it, Dr. Hellmayr writes me that comparisons were made chiefly between the Samiría skin and a Shanusi example and three topotypes of *elegans*. Although he did not publish the fact, Dr. Hellmayr recorded in his notes that a specimen from Archidona, eastern Ecuador, had larger, more fan-shaped buff markings, especially below, than the Peruvian birds. This is in agreement with the facts shown by the series in hand.

One skin from the Río Suno, above Avila, Ecuador, has the streaks on scapulars and upper wing-coverts obsolete, but the other characters of *ornatus* are unmodified. A male from Florencia, southeastern Colombia, is quite like the rest of the series and is an unquestioned *ornatus*. Two birds from farther north, at Buena Vista, above Villavicencio, are again different and are nearest to *elegans*, of the same grayish tones but with the bill extensively whitish and with the spots on the mantle a little smaller. I have no doubt that these represent the form found in "Bogotá" collections, of which various specimens have been identified as *insignis*. There is, in fact, a much closer resemblance to *insignis* than to *ornatus*, but the pectoral spots are rounder, less fan-shaped, and their dark terminal margins are broader; the lower throat is a little more buffy but far from the deep ochraceous tone of *ornatus*. Identity with *elegans* is improbable from a geographic standpoint even were the whitish bill and other points of difference not in evidence. This form therefore may be described as new.

One male and three females in the Carnegie Museum, labeled as from São Paulo de Olivença, are indistinguishable from *ornatus*. This is most puzzling if it be assumed that the specimens came from the exact sites where twelve skins of *juruanus* were secured, which also are labeled

São Paulo de Olivença. However, the four *ornatus* were taken on different dates from any of the twelve *juruanus*, and I suspect that a somewhat different habitat is involved, connected ecologically, if not otherwise, with the left bank of the Amazon.

***Xiphorhynchus spixii similis*, new subspecies**

TYPE from Buena Vista (above Villavicencio), Colombia; altitude 4500 feet. No. 122,088, American Museum of Natural History. Adult female collected March 9, 1913, by Chapman, Cherric, et al.

DIAGNOSIS.—Nearest to *X. s. elegans* of northwestern Matto Grosso and the Rio Madeira region, Brazil, but bill much paler, more whitish; shoulder less rufous; scapulars and upper wing-coverts less conspicuously or not at all streaked with whitish.

Differs from *ornatus* by much more grayish general hue with distinctly smaller and less ochraceous spots above and below and a more whitish throat. Differs from *insignis* by slightly more buffy throat and slightly broader and more extensive (but paler) spots on the mantle.

RANGE.—Eastern slope of eastern Andes of Colombia, in the Orinoco drainage.

DESCRIPTION OF TYPE.—Top of head grayish brown with blackish tips, whitish shafts, and rounded subterminal spots of pale buff; hind neck and mantle brownish Medal Bronze with narrow, elongate-oval spots of Pinkish Buff terminally outlined with blackish, which are narrower posteriorly and obsolete on the lowermost mantle-feathers; rump and upper tail-coverts dark Ferruginous. Lores whitish; a narrow superciliary line also whitish, tinged with buff posteriorly; auriculars and malar region pale buffy, with narrow dusky margins; chin whitish; throat pale Cream-Buff with narrow dusky terminal margins; breast and sides with broad, guttate, central spots of Cream-Buff  $\times$  Warm Buff, strongly outlined distally with blackish, but with the broad margins of the feathers Light Brownish Olive; belly a little paler and flanks a little darker, with the spots becoming smaller and less distinct posteriorly but not perfectly obsolete; femoral areas darker and browner, immaculate; under tail-coverts like lower belly. Wings Auburn  $\times$  Kaiser Brown with dusky tips on the primaries, broadest on outermost; outer margins of primaries tinged with light brownish olive, upper wing-coverts on exposed portions light Brownish Olive, the innermost greater ones and the inner webs of the remaining greater ones rufescent, and the lesser series along radial margin suffused with dull rufous; upper coverts and scapulars unstreaked; under wing-coverts light Cinnamon-Buff; tail dark Chestnut. Maxilla (in dried skin) pale grayish (with whitish at tip and along the tomlia); mandible apparently mostly whitish; feet brownish. Wing, 97.5 mm.; tail, 84; tarsus, 21; (bill broken).

REMARKS.—The only female is in practically adult plumage, being determinable as immature only by a slightly coarser texture of plumage and less acuminate outer primary covert. In coloration it is much like the adult male though slightly darker and with fine, short hair-streaks on the upper wing-coverts and scapulars. Size smaller; wing, 91 mm.; tail, 69; exposed culmen, 25; culmen from base, 30.5; tarsus, 20. The bill is exactly like that of the male, so far as the latter can be determined

with its terminal portion missing, and shows the tip of the maxilla, the tomtia, and the mandible whitish.

It is difficult to find anything written about "Bogotá" skins, and the only recorded examples of Colombian birds of the present species that are not Bogotá skins are the two here discussed and the specimen of *ornatus* from Florencia. Depending on the localities reached by "Bogotá" collectors, *ornatus* or *similis* might appear in these trade-skin collections. Dr. Lowe kindly writes me that five Bogotá skins in the British Museum are reasonably like four Iquitos specimens (collected by Whitely), but no great differences can be found in them or in two from Chayavitas and one from Yurimaguas, though the latter bird is paler on the under parts (=less strongly spotted or streaked). Without comparing these specimens with our series and without knowing whether Whitely may not have collected some birds on the right bank of the Amazon opposite Iquitos, it is impossible to allocate these records with certainty. The various forms are so well distinguished in the specimens at hand that it is difficult to suppose the distinction a purely casual one, though some overlapping of characters is to be expected when intermediate localities are represented in collections.

#### SPECIMENS EXAMINED

*X. s. spizii*.—BRAZIL: Pará, 1 ♂; Utinga, 1 ♂; Providencia, 1 ♂, 1 ♀; Ananideua, 1 ♂; Rio Tocantins, Mocajuba, 1 ♂, 2 ♀; Baião, 1 ♂; Baião, Pedral, 2 ♂, 1 (?); Rio Xingú, Villarinho do Monte, 2 ♂, 1 ♀; Tapará, 1 ♀; Rio Tapajoz (right bank), Tauary, 1 ♂, 1 ♀; Aramanay, 1 ♀; Piquiatuba, 2 ♀; Caxiricatuba, 1 ♂, 1 ♀, 1 (?).

*X. s. elegans*.—BRAZIL: Rio Roosevelt, "Broken Canoe Rapids," 1 ♀; "6th of March Rapids," 1 ♀; Rio Madeira, Porto Velho, 1 ♂, 1 ♀, 1 (?); Rosarinho, 2 ♂, 3 ♀; Rio Amazonas, Villa Bella Imperatriz (Santa Clara), 1 ♀; Manaqueri, 1 ♂; Caviana, 1 ♂<sup>1</sup>.

*X. s. juruanus*.—BRAZIL: Teffé, 3 ♂, 3 ♀; São Paulo de Olivença 8 ♂<sup>1</sup>, 4 ♀<sup>1</sup>. PERÚ: Astillero, 2 ♂, 1 ♀; Orosa, 1 ♂, 3 ♀; Sarayacu, 1 ♂, 4 ♀.

*X. s. insignis*.—PERÚ: Rio Ucayali, Santa Rosa, 2 ♂, 4 ♀; Lagarto, 6 ♂, 4 ♀; Río Pichis, Puerto Bermúdez, 1 ♂<sup>2</sup>, 1 ♀<sup>2</sup>.

*X. s. ornatus*.—PERÚ: Puerto Indiana, 1 ♂, 1 ♀ (type). ECUADOR: Río Suno, above Avila, 1 ♂; lower Río Suno, 1 ♀; mouth of Río Curaray, 1 ♀. COLOMBIA: Florencia, 1 ♂. BRAZIL: (? near) São Paulo de Olivença, 1 ♂, 3 ♀.

*X. s. similis*.—COLOMBIA: Buena Vista (above Villavicencio), 1 ♂ (type), 1 ♀.

#### *Xiphorhynchus obsoletus palliatus* (Des Murs)

*Dendrornis palliatus* DES MURS in CASTELNAU, 1856 (June), 'Expéd. Amér. Sud.', pt. 7, I (3), livr. 18, Oiseaux, p. 46; idem, 1856 (Dec.), *tom. cit.*, livr. 19, Pl. xv, fig. 1.—no locality; type in Paris Mus. from Sarayacu, Perú.

<sup>1</sup>Specimens in Carnegie Museum, Pittsburgh.

<sup>2</sup>Specimens in Field Museum of Natural History, Chicago.

Five topotypes are at hand with other examples from Lagarto and Santa Rosa, upper Ucayali, from Orosa and Puerto Indiana, on opposite banks of the Amazon, and from the mouth of the Río Curaray, eastern Ecuador.

These birds all agree with each other in considerable detail and differ from one hundred and seventy examples of the species from numerous localities in Brazil and Venezuela. These other examples are not uniform and may be divided into two good subspecies which are quite distinct in the hearts of their ranges though they intergrade over rather a wide area.

Thus the birds from the south bank of the Amazon, extending westward from the Río Tocantins to the left bank of the Madeira (and possibly to Fonteboa), are characterized by their olive or grayish-olive coloration on the under side and relatively little rufescent tinge on the back, with the throat quite pale buffy and the streaks and spots above and below relatively whitish. They belong to typical *obsoletus*.

Skins from the upper Orinoco in Venezuela, the vicinity of Mt. Duida, and the upper stretches of the Río Negro in Brazil, are distinctly more warmly colored, with the throat deeper buff and the streaks and spots more buffy or ochraceous than whitish. They approach *palliatu*s to some extent, but the pattern is finer, with the streaks and spots not so broad, and the coloration does not reach so deep a tone. Apparently these birds are entitled to the name *notatus* Eyton, the type of which is said by Hellmayr [Field Mus. Nat. Hist. Publ., Zool. Ser., XIII (4), p. 317, footnote b (on p. 318), 1925] to be an extreme example of a possible northern variety, more warmly colored than typical *obsoletus*.

Judging by the material at hand, *notatus* ranges down the Orinoco as far as Suapuré, but specimens from Caicara, Río San Feliz, Río Mato, and Saucupana are closer to *obsoletus*. Likewise on the Río Negro in Brazil, birds from as far downstream as Tatú on the right bank and Santa Isabel on the left bank are closer to *notatus*, though they show a tendency toward *obsoletus*; skins from Tabocal, Yavanari, and Ilha Sta. Maria are too intermediate to place satisfactorily; and examples from Muirapinima and Igarapé Cacao Pereira, not far above the mouth of the river, are very close to typical *obsoletus*. Birds from Faro are mostly inseparable from *obsoletus*, though a single skin from Serra do Espelho (the others are from Castanhal, Sto. Antonio de Cachoeira, and S. José) is nearer *notatus*. Probably, judging from the Faro birds and the skins from the lower Orinoco, *obsoletus* ranges northward to the Guianas, though I have no material from that region for comparison.



Probably the Fonteboa birds (described as *multiguttatus* by Lafresnaye) are intermediate between *obsoletus* and *palliatu*s. They are said to be similar to Rio Negro examples (Hellmayr, *loc. cit.*) but should be studied further, as should Matto Grosso examples of which I have no representatives.

### ***Xiphorhynchus obsoletus parvimaculatus* Carriker**

*Xiphorhynchus obsoletus parvimaculatus* CARRIKER, 1934, Proc. Acad. Nat. Sci. Phila., LXXXVI, p. 323—Huacamayo, Prov. Carabaya, Perú; ♂; Acad. Nat. Sci. Philadelphia.

I have not seen this new form which is from a portion of Perú where the species has not been found heretofore. Judging by the description, it bears some resemblance to the *ocellatus* group, especially in respect to the reduction of dorsal markings and the reduction in the rufescence of the upper wing-coverts.

#### SPECIMENS EXAMINED

*X. o. obsoletus*.—BRAZIL: Rio Tocantins, Mocajuba, 1 (?); Ilha Pirunum, 1 ♀; Rio Xingú, Tapará, 1 ♂; Villarinho do Monte, 1 ♂; Rio Tapajoz, Santarem, 1 (?); Aramanay, 1 ♂; Igarapé Brabo, 4 ♂, 1 ♀; Rio Amazonas, Cussary, 1 ♂; Villa Bella Imperatriz (Sta. Clara), 3 ♀, 1 (?); Rio Madeira, Borba, 2 ♂, 2 ♀ (incl. cotype of *Dendroplex similis* Pelzeln); Igarapé Auará, 3 ♂, 1 ♀; Rosarinho, 4 ♂, 1 ♀ 1 (?); Sto. Antonio de Guajará, 2 ♂, 6 ♀; Rio Jamundá, Faro (Castanhal, S. José, and Sto. Antonio de Cachoeira, 4 ♂, 2 ♀ 1 (?); Rio Negro, Muirapinima, 2 ♂, 1 ♀; Igarapé Cacao Pereira, 1 ♂. VENEZUELA: Rio Orinoco, Sacupana, 1 ♂; Rio Mato, 1 ♀; Caicara, 1 ♂, Rio San Feliz, 1 ♂.

*X. o. notatus*.—VENEZUELA: Mt. Duida, Caño León, 1 ♂, 1 ♀; Esmeralda, 11 ♂, 9 ♀; Lalaja, 2 ♀; Playa del Río Base, 1 ♂, 1 ♀; Savana Grande, 1 ♂; (western) foot of Mt. Duida, 1 ♂, 1 ♀; Boca de Sina, Río Cunucunumá, 1 ♀; Río Orinoco, Munduapo, 1 ♂, 1 ♀; Suapuré, 1 ♂, 1 ♀; Río Cassiquiare, Buena Vista, 4 ♂, 4 ♀; El Meroy, 9 ♂, 4 ♀; opposite El Meroy, 1 ♂, 3 ♀; above Ihuapo, 1 ♀; mouth of Río Ocamo, 7 ♂, 4 ♀; opposite mouth of Río Ocamo, 4 ♂, 5 ♀; Solano, 1 ♀; junction of Río Huayná and Río Cassiquiare, 1 ♀. BRAZIL: Rio Uaupés, Tahuapunto, 1 ♂; Rio Negro, Tatú, 2 ♂, 1 ♀, 1 (?); San Gabriel, 1 ♂, 1 ♀; Santa Isabel, 2 ♂, 1 ♀.

*X. o. notatus* × *obsoletus*.—BRAZIL: Rio Negro, Taboal, 3 ♂; Yavanari, 2 ♂, 2 ♀; Ilha Santa Maria, 1 ♀; Rio Jamundá, Faro (Serra do Espelho), 1 ♂.

*X. o. palliatu*s.—PERÚ: Río Ucayali, Sarayacu, 5 ♂; Santa Rosa, 1 ♂; Lagarto, 2 ♂; Río Amazonas, Orosa, 1 ♀; Puerto Indiana, 1 ♀. ECUADOR: mouth of Río Curaray, 2 ♂.

### ***Xiphorhynchus ocellatus ocellatus* (Spix)**

*Dendrocolaptes ocellatus (guttatus)* SPIX, 1824, 'Av. Bras.', I, p. 88, Pl. xci, fig. 1—"in sylvis campatribus Piahu," errore = mouth of Rio Madeira, Brazil; HELLMAYR, 1925; Munich Mus.

[*N(asia) Beauperthuyssii* LAFRESNAYE, 1850, Rev. Mag. Zool., (2) II, p. 419—"Perú" (=Cumaná, Venezuela) and banks of the Amazon, Pebas and Santa Maria, Perú; Paris Mus. or Mus. Comp. Zool., Cambridge.]

*Dendroornis weddellii* DES MURS in CASTELNAU, 1856 (June), 'Expéd. Amér. Sud.,' pt. 7, I (3), livr. 18, Oiseaux, p. 46, Pl. xiv, fig. 2—no locality, = Peruvian Amazon; Paris Mus.

Birds from the right bank of the Rio Madeira are typical of *ocellatus*, and skins from farther east, along the south bank of the Amazon and its southern affluents, are inseparable, though there appears to be a hiatus in distribution between the right bank of the Tapajoz and the left bank of the Xingú, as will be discussed later. North of the Amazon the case is somewhat different.

I am unable to place the records of *ocellatus* from Pebas and Santa Maria without examination of the specimens. They have been examined by Hellmayr, who found them inseparable from the type of *ocellatus*, but our extensive series of that form places some doubts on the correctness of the assignment. All our specimens from north of the Amazon are somewhat different from typical *ocellatus*, while *napensis* occurs in Perú, only a few miles west of Pebas.

There is great probability that the Pebas birds belong to a slightly differentiated form found on the west bank of the Rio Negro, Brazil, from near its mouth to its source, and on the west bank of the Cassiquiare and on its affluent, the Huayná, in Venezuela.

A good series from this range is, in general, distinguishable from true *ocellatus* by darker margins of the buff pectoral spots which are, in turn, perhaps slightly larger than in Rio Madeira skins. The mantle averages more heavily streaked, sometimes with the streaks slightly expanded to form rounded, subterminal dots. Nevertheless, numerous specimens are not more pronouncedly streaked on the back than *ocellatus*. The best-marked examples, on the other hand, are not far removed from certain skins of *napensis*, showing clearly the full intergradation of *napensis* and *ocellatus*. The shoulder is even more strongly and deeply rufescent than in *ocellatus*, being far different from the condition in *chunchotambo*.

If there is an intermediate form found in this region, it may have to bear the name *beauperthuyssii* or *weddellii*. There is so much confusion surrounding the former name that it may have to be dropped as unidentifiable. Elliot and, later, Bangs contended that a skin from an unknown locality, in the Lafresnaye collection, now in Cambridge, Mass., labeled "*Beauperthuyssii*" in Lafresnaye's handwriting, is the type of that species, but Ménégau and Hellmayr concluded that two birds in the Paris Museum, from Pebas and Santa Maria, collected by

Castelnau and Deville, are the cotypes. In the original description, Lafresnaye mentions the species as being in the Paris Museum but says nothing of any specimens of his own, which he may or may not have had at the moment. In any case, he confused two species in his account, a form of *ocellatus* and *X. susurrans jardinei*. The latter bird was represented in the Paris Museum by a specimen collected by Beuperthuys near Cumaná, Venezuela (though Lafresnaye thought it was from Perú), to which Pucheran and Lafresnaye had given the manuscript name *Beuperthuysii*. In the published description, Pucheran and Lafresnaye are cited as the authors of the name (although the description was drawn up from a specimen of *ocellatus* subsp.). The Beuperthuysian skin is specifically mentioned in the original account, with the obvious result that it is a cotype of the published name, *Beuperthuysii*, as much as are the Pebas and Santa Maria birds. No mention is made of any other specimens and there is no assurance whatever that Lafresnaye had, at the time of the description, the specimen, now in the Museum of Comparative Zoology, Cambridge, which Elliot and, later, Bangs believed to be the type. This specimen is undoubtedly from the Lafresnaye collection but may have reached his hands after 1850.

In any case, there is such confusion in regard to this name that any attempt to fix it on a particular bird must be purely arbitrary.

The name *weddellii* is definitely based on the Pebas and Santa Maria specimens of Castelnau and Deville, and if these are found to be like Cassiquiare skins, the name will be available for the form which I have briefly characterized. Until such comparison can be made the name *ocellatus* must be applied to the birds from this entire region.

*Xiphorhynchus pardalotus* seems to replace the *ocellatus* group in the Guianan region and the adjacent areas of northeastern South America, yet it is not close enough taxonomically to warrant its inclusion in the same species. According to our extensive series, *ocellatus* is absent from the area between the Tapajoz and Xingú Rivers, reappearing on the eastern bank of the Xingú and continuing to beyond the Tocantins. On the other hand, there are five skins of *pardalotus* from this area of intermission. Furthermore, the skins of *ocellatus* from Faro, north of the Amazon, are from near the town of that name, while *pardalotus* was taken at several nearby, but not identical, sites, some of them, at least, west of the Jamundá while Faro itself is east of it. From the Rio Negro, there are specimens of *pardalotus* from Manaos and Camanaos on the left bank, while *ocellatus* appears on the right bank from near the mouth to the junction of the Cassiquiare and on the west bank of the latter stream

to the Río Huayná but not so far as the Orinoco; *pardalotus*, however, occupies the east bank of the Cassiquiare and the region about the base of Mt. Duida, continuing down the Orinoco at least on the right bank, according to published accounts, and probably joining the range of the species in British Guiana. The only suggestion of similarity in pattern between *ocellatus* and *pardalotus* is in the occasional trace of blackish margins on the dorsal streaks of some *ocellatus* from the upper Río Negro-Cassiquiare region, but the gap is very wide in this and other respects.

Returning to the south bank of the Amazon, there is apparent, to the westward of the Río Purús, as far as the lower Ucayali (and possibly to the right bank of the lower Huallaga), a recognizable differentiation from typical *ocellatus* to which no name has yet been applied. The most striking characteristic is the loss of the broad patch of bright rufous color on the shoulder that is found, without clear exception, in the series of *ocellatus* from both north and south of the Amazon. This form may be known as follows.

***Xiphorhynchus ocellatus perplexus*, new subspecies**

TYPE from Sarayacu, Río Ucayali, Perú. No. 238,326, American Museum of Natural History. Adult male, collected July 22, 1927, by Carlos Olalla and sons.

DIAGNOSIS.—Nearest to *X. o. ocellatus* of the right bank of the lower Río Madeira, Brazil, but wings, tail, and uropygium darker rufous; radial margin of wings browner, only faintly tinged with deep rufous; breast darker, with the pale spots more conspicuously outlined with dusky; maxilla, in dried skins, a little paler horn-color.

RANGE.—Lower Río Ucayali, Perú, eastward at least as far as Tefé, possibly westward to the right bank of the lower Huallaga.

DESCRIPTION OF TYPE.—Top of head Fuscous, with blackish tips and margins and buff shaft-lines slightly expanded subterminally; hind neck lighter brown with shaft-marks slightly broader; mantle Saccardo's Umber × Cinnamon Brown with narrow, pale buffy shaft-streaks, broadest near the neck and obsolete on lower portion; rump and upper tail-coverts light Bay. Lores buffy whitish; malar region a little more whitish and with narrow dusky outlines; auriculars with dusky margins and whitish shafts; a narrow line of feathers above the auriculars with shaft-streaks more whitish than those on the top of the head; sides of neck like hind neck but with pale markings broader; chin and throat Pinkish Buff with narrow, dusky, terminal margins, obsolete on the chin but rather prominent on the throat; lateral throat-feathers with outer margins blackish, forming a dark submalar line; upper breast-feathers with central spots of Pinkish Buff, outlined with blackish brown, the lateral margins of the feathers a little darker than Light Brownish Olive; sides and flanks Light Brownish Olive with narrow buffy shaft-streaks; lower breast similar, with shaft-streaks wider but less sharply defined; belly pale Isabella Color with ill-defined buffy shaft-streaks; under tail-coverts lightly tinged with dull rufous. Wings light Bay, clearest on tertials; outer margins of primaries and secondaries on more basal portions tinged with brownish; terminal portion of inner webs of primaries blackish, most extensive on outer feathers; outer secondaries with a slight dusky shading in the

same position; innermost greater upper wing-coverts like the tertials; outer ones and primary-coverts with outer margins near the color of the back; median series a little less rufescent and more brownish; lesser series like median series except for a slight rufescent tinge on a few feathers immediately adjoining the radial margins; tail Bay. Bill (in dried skin) light Hair Brown, darker at base of maxilla; feet dull Hair Brown. Wing, 98 mm.; tail, 77.5; exposed culmen, 29; culmen from base, 33.25; tarsus, 21.

REMARKS.—The general coloration of this form is much closer to *ocellatus* than to *napensis* although the markings are a little bolder than in *ocellatus*. The dark coloration of the wings, tail, and uropygium are exactly those of *napensis*, but the dull coloration of the shoulder is shared regularly in the group only by *chunchotambo* and *brevirostris*; an occasional *napensis* is similar, but very rarely so. With this combination of characters, although it is one to be expected in an area near to the meeting ground of the other three forms, it may not be amiss to give a name to the possessors.

A single Teffé bird is slightly different from three Peruvian examples in having the pale pectoral markings as broad as in some *napensis*, and the bill as dark as in the palest *ocellatus*. In the other characters of *perplexus* it agrees with the Peruvian bird and is not to be matched by any skins of *ocellatus* at hand.

A record of *ocellatus* from the lower Huallaga (probably from Chamicuro) probably belongs with *perplexus*, though it may be *chunchotambo*.

### ***Xiphorhynchus ocellatus napensis* Chapman**

*Xiphorhynchus chunchotambo napensis* CHAPMAN, 1924 (July 2), Amer. Mus. Novitates, No. 123, p. 8—upper Río Suno, eastern Ecuador; ♂; American Mus. Nat. Hist.

Examples from Puerto Indiana and Anayacu, north of the Amazon in Perú, are best referred to this subspecies, although *ocellatus* is recorded from Pebas, not far to the eastward. For the most part they can be matched with typical *napensis* from higher up the Napo, though extreme examples from eastern Ecuador are more boldly marked than any of the Peruvian examples, showing, on their part, a tendency toward *chunchotambo*. As noted in an earlier paragraph, examples of *ocellatus* from the upper Río Negro, Brazil, and the region of the Río Cassiquiare, Venezuela, show an intermediacy between *ocellatus* and *napensis*, and the Puerto Indiana and Anayacu birds seem to be in the line of connection.

Strangely enough, three males and a female from Lagarto, upper Ucayali, are also indistinguishable from *napensis*, in spite of the occurrence of *perplexus* at Sarayacu, lower down the river, completely dividing

the range of *napensis*. There is no suggestion of their intergrading with *perplexus* nor with *chunchotambo*, nor are there any peculiarities by which a separation could be justified. I judge the ancestral range of *napensis* to have been across the Amazon from the mouth of the Napo to the Ucayali and along the entire course of this stream, into which range *perplexus* pushed its way from the eastward, possibly after *napensis* withdrew in part to the isolated region at the head of the Ucayali.

A single skin from Pomará, left bank of the middle Marañón, is intermediate between *napensis* and *chunchotambo* but is closer to *napensis*. The streaks on the top of the head are broader than in most *napensis*, but those on the mantle are narrower and those on the upper abdomen less well developed. Furthermore, the coloration is slightly warmer and the radial margin of the wing is strongly rufescent, which is true of most *napensis* but not of *chunchotambo*. Presumably parts of the ranges of these two forms are separated by the course of the Marañón, though there is no apparent barrier between the two in the neighborhood of the upper Ucayali.

***Xiphorhynchus ocellatus chunchotambo* (Tschudi)**

*Dendrocolaptes Chunchotambo* TSCHUDI, 1844 (May), Arch. Naturg., X (1), p. 295—Perú (=Chanchamayo Valley); Mus. Neuchâtel.

Twenty-two skins from the Andean regions of Perú and an equal number from northern Bolivia show a distinct segregation into two recognizable forms, to one of which the name *chunchotambo* is applicable. Tschudi's description in the 'Fauna Peruana,' Aves, p. 241, 1846, gives one or two of the distinctive characteristics which help to decide the issue (though there is one point of divergence), and one of Tschudi's original examples, kindly lent by the U. S. National Museum, removes any doubts that may have remained. A young bird from La Merced adds its consistent measure of evidence. Tschudi's specimen agrees closely with skins from the upper and lower Huallaga while the birds from southeastern Perú and Bolivia together agree in their distinction from the more northern examples, making this southern form obviously the one entitled to a new name, given in the description which follows shortly.

At the northernmost end of the range of *chunchotambo* there is a trend toward *napensis*, and a specimen from Río Negro, west of Moyobamba, is very like that one from Pomará, on the left bank of the middle Marañón, which seems to be closer to *napensis*, as detailed above.

A male from Pozuzo is not quite typical, but is somewhat faded and matches the series of *chunchotambo* much better than the specimens of

*napensis* from the upper Ucayali, to which it bears some geographical affinity.

Records from Perú which presumably belong to *chunchotambo*, in addition to some from localities included in the list of specimens examined, are from Amable Maria, Monterico, La Gloria, Huambo, Chirimoto and Jeberos.

***Xiphorhynchus ocellatus brevirostris*, new subspecies**

TYPE from Río Inambari, southeastern Perú; altitude 2200 feet. No. 132,728, American Museum of Natural History. Adult male collected March 16, 1915, by H. and C. Watkins; original No. 22.

DIAGNOSIS.—Similar to *X. o. chunchotambo* of central and northern Perú but differs by having the bill shorter and paler, with the culmen averaging more convex in outline; wing and tail shorter; general color averaging browner, less olivaceous; stripes on mantle broader, more pronounced; upper throat more nearly immaculate; stripes on lower under parts broader but less sharply defined.

RANGE.—Tropical Zone of southeastern Perú and northern Bolivia.

DESCRIPTION OF TYPE.—Top of head dark Sepia, slightly more dusky at tips of feathers and with pale buffy shaft-streaks widening distally into prominent obovate spots; mantle distinctly brighter, near dark Saccardo's Umber, with broad, elongate-ovate shaft-stripes, narrower adjoining the rump; rump and upper tail-coverts Chestnut × Burnt Sienna. Lores whitish, a double row of whitish-centered feathers over the auriculars; auriculars and upper malar region with pale buffy shaft-stripes and dusky margins. Chin and upper throat pale buff with very narrow dark tips on lower portion (most examples have these tips obsolete or nearly so); lower malar region similar, with a dusky line separating this region from the throat; lower throat and upper breast with buff centers and dusky brown margins and tips giving a spotted appearance; sides of breast and neck with centers narrower and more streaklike; lower breast with broad buffy shaft-stripes not very sharply defined from the margins which are Dresden Brown × Light Brownish Olive; these margins paler on lower belly, making the streaks even less well defined and the general color of the area lighter. Wings externally rufous with a slight golden brown wash on the exterior margins; lesser upper wing-coverts light tawny with faintly brighter shaft-lines; middle and greater coverts somewhat duller; terminal portions of primaries and secondaries somewhat dusky; under wing-coverts ochraceous cinnamon; inner margins of remiges deeper cinnamon; tail light Bay. Bill with culmen strongly curved, gonys rectilinear; color (in dried skin) dull brownish-white, dusky at base of maxilla; feet grayish brown. Wing, 95 mm.; tail, 81; exposed culmen, 26.5; culmen from base, 30; tarsus, 21.

REMARKS.—Females like the males but smaller. The measurements of typical *chunchotambo* appear to be within the following range of figures. Males: wing, 102–107 mm. (av., 104.6); tail, 85–98 (av., 91.1); culmen from base, 33.5–36 (av., 35.1); tarsus, 22–23 (av., 22.6). Females: wing, 101; tail, 84; culmen from base, 36–36.5; tarsus, 21.

The measurements of *brevirostris* are as follows: Males: wing, 95–101 (av., 96.7); tail, 70.5–83 (av., 78.1); culmen from base, 28.5–32.25 (av., 30.2); tarsus, 20–21 (av., 20.5). Females: wing, 87–99 (av., 91); tail, 64–80 (av., 72.1); culmen from base, 29–33 (av., 30.5); tarsus, 19–21 (av., 20.3).

Tschudi's measurements of the type of *chunchotambo* are given in inches and lines, presumably of the old Prussian standard, and translated into the metric scale show a wing of 105 mm. and a bill of 35.8 mm. The paratype in hand has the wing, 103 mm.; tail, 89; culmen from base, 35; and tarsus, 23. Tschudi also mentions the dusky margins on the feathers of the throat but makes no mention of the stripes on the mantle, which may be poorly developed in some of the northern birds, but are very prominent in the form I have described as new.

The young bird from La Merced is small, but owing to its immaturity it can not be used unreservedly for comparative purposes. The throat is rather distinctly marked at the tips of the feathers and the mantle is relatively narrowly streaked, according well with the northern series.

Peruvian records which belong to *brevirostris* are from Cosñipata, Río Huacamayo, Yahuarmayo, Río Cadena, San Gaban, and Marcapata.

#### SPECIMENS EXAMINED

*X. o. ocellatus*.—BRAZIL: Rio Madeira, Borba, 5 ♂; Igarapé Auará, 9 ♂, 5 ♀, 1 (?); Rio Amazonas, Villa Bella Imperatriz, 6 ♂, 3 ♀, 2 (?); Rio Tapajoz, Igarapé Brabo, 8 ♂, 2 ♀; Boim, 1 ♂; Rio Xingú, Tapará, 3 ♂, 6 ♀; Rio Tocantins, Baião, 1 ♂, 1 ♀; Rio Jamundá, Faro, 3 ♂, 1 ♀, 1 (?); Rio Negro, Igarapé Cacao Pereira, 5 ♂, 3 ♀; Muirapinima, 2 ♂, 1 ♀; Tabocal, 3 ♂, 2 ♀; Yucabi, 1 ♀; Mt. Curycurari, 4 ♂, 3 ♀; Yavanari, 1 ♂, 1 ♀; Tatú, 5 ♀, 3 ♂, 2 (?); Marabitanas, 1 ♂, 1 ♀; Rio Uaupés, Tahuapunto, 4 ♂, 7 ♀. COLOMBIA: opposite Tahuapunto, 1 ♂. VENEZUELA: Río Huayña, junction with the Cassiquiare, 5 ♂, 7 ♀.

*X. o. perplexi*.—PERÚ: Sarayacu, 3 ♂ (incl. type). BRAZIL: Teffé, 1 ♂.

*X. o. napensis*.—ECUADOR: upper Río Suncu, 2 ♂ (incl. type), 1 ♀; lower Río Suncu, 2 ♂, 1 ♀; below San José, 1 ♂, 2 ♀; mouth of Río Curaray, 3 ♂; mouth of Lagarto Cocha, 2 ♂; Zamora, 1 ♂. PERÚ: Pomari, 1 ♂; Puerto Indiana, 2 ♂, 1 ♀; Anayacu, 2 ♂, 1 ♀; Lagarto, upper Ucayali, 3 ♂, 1 ♀.

*X. o. chunchotambo*.—PERÚ: "Voyager de M. Tschudi" (paratype), 1(?)<sup>1</sup>; La Merced, 1 ♀; Pozuzo, 1 ♂<sup>2</sup>; Huachipa, 4 ♂<sup>2</sup>, 2 ♀<sup>2</sup>; Rioja, 1 ♀<sup>2</sup>; Río Negro, west of Moyobamba<sup>3</sup>, 1 ♂; Guayabamba, 1 ♂.

*X. o. brevirostris*.—PERÚ: Río Inambari, 1 ♂ (type), 2 ♀; La Pampa, 2 ♂, 1 ♀; Río Tavana, 3 ♂. BOLIVIA: Todos Santos, 3 ♂, 1 ♀; Mission San Antonio, 3 ♂,

<sup>1</sup>Specimen in U. S. National Museum, Washington.

<sup>2</sup>Specimens in Field Museum of Natural History, Chicago.

<sup>3</sup>Mr. Carriker's recent (1934, Proc. Acad. Nat. Sci. Phila., LXXVI, p. 325, footnote<sup>3</sup>) and unwarranted statement to the contrary notwithstanding; the locality is west of Moyobamba, and west of Rioja, on the road to Chachapoyas, at an elevation of about 2000 feet. I have no doubt that there may be another "Río Negro" north of Moyobamba at another elevation, but it has nothing to do with my citations of specimens as given above.



7 ♀; mouth of Río San Antonio, 1 ♂, 1 ♀; Tres Arroyas, 1 ♂, 1 ♀; Vermejo, 1 ♂; Río Espíritu Santo, 1 ♂<sup>2</sup>, 2 (?)<sup>2</sup>.

*X. pardalotus*.—FRENCH GUIANA: Tamanoir, 3; Ipousin, 1. BRITISH GUIANA: Tumatumari, 7; Potaro Landing, 6; Minnehaha Creek, 1; Rockstone, 4; Meamu-mouth, 1. VENEZUELA: Río Orinoco, La Unión, 1; Suapure, 3; Mt. Duida region, 50; Río Cassiquiare, Buena Vista, 2; Solano, 3. BRAZIL: Río Negro, Camanaos, 1; Manaos, 1; Faro (San José), 4; (Castanhal), 8; (mouth of Río Paratucú), 5; (Serra do Espelho), 3; Obidos, 2; Rio Tapajoz (right bank), Aramanay, 5.

# AMERICAN MUSEUM NOVITATES

Number 757

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

Nov. 30, 1934

59.88, 6 (85)

## STUDIES OF PERUVIAN BIRDS. XVI<sup>1</sup>

NOTES ON THE GENERA *GLYPHORHYNCHUS*, *SITTASOMUS*, *DECONYCHURA*, *MARGARORNIS*, *PREMNORNIS*, *PREMNOPLEX*,  
AND *SCLERURUS*

By JOHN T. ZIMMER

Following my previous custom, the names of colors are capitalized when direct comparison has been made with Ridgway's 'Color Standards and Color Nomenclature.'

### *Glyphorhynchus spirurus castelnaudi* Des Murs

*Glyphorhynchus Castelnaudi* (LAFRESNAYE MS.) DES MURS in CASTELNAU, 1856, 'Expéd. Amer. Sud.', pt. 7, I (3), livr. 18, Oiseaux, p. 47, Pl. xv, fig. 2—Santa Maria, Perú; Paris Mus.

Peruvian birds from various parts of the country, except the southeastern corner, are relatively uniform or at least without differences associated with their distribution. The general characteristics are a relatively deep cinnamonaceous clay-colored throat with blackish specks at the laterodistal angles of the feathers (the tips of the feathers in the middle are somewhat dusky but not so prominently so); the breast is marked with moderately broad, whitish, sagittate shaft-spots, broadly margined with light ochraceous-brown; the lower under parts are paler with some grayish tinge usually present, and with narrow shaft-streaks of pale buff or whitish not always conspicuous but usually present and sometimes quite well marked; the pale band across the inner webs of most of the remiges is relatively light-colored but variable. The upper parts are rather rich rufous or brown, with the top of the head a little darker, though there is considerable variation in the exact tone. The ground color of the throat is also variable and sometimes is quite pale though always with a definite cinnamon-ochraceous tone and with the dusky specks as mentioned, at least on the lower portion. Birds from north of the Amazon, east to Pebas, are no different, though they do not reach the extreme of olivaceous tone exhibited by some (but not all) of the skins from south of that river. One example from Anayacu, between Pebas and Puerto Indiana, is rather darker on the throat than

<sup>1</sup>Earlier papers in the present series comprise American Museum Novitates Nos. 500, 509, 523, 524, 538, 545, 558, 584, 646, 647, 668, 703, 728, 753, and 756.

the others and has the pectoral markings a little less prominent, but it is unusual. A Pebas bird, the most nearly topotypical example of *castelnaudi* at hand, agrees with the general series of north-Peruvian birds and helps to fix the allocation of the name.

A long series from the region of Mt. Duida, Venezuela, and the upper Rio Negro, Brazil, are somewhat different, though they are decidedly closer to *castelnaudi* than to *spirurus*. Their ventral coloration averages browner and less olivaceous, while the throat has a decidedly reddish tone that is more intense than that shown by any other subspecies, though the area is less marked with dusky than in any other form. The pectoral spots average smaller and have more of a buffy tinge, the band across the inner webs of the rectrices averages more deeply cinnamonaceous, and the belly is less noticeably streaked. This form is so constant in its characters that it deserves recognition and will be found described below. It ranges from near the mouth of the Rio Negro on the right bank, northwestward to eastern Colombia, and shows its influence in north-eastern Ecuador. Skins from the lower Rio Negro are close to *castelnaudi*, but in the neighborhood of the Rio Suno there is a definite tendency toward the new form, as will be discussed below.

Eastward along the south bank of the Amazon as far as the left bank of the Rio Madeira, there appears to be little distinction from *castelnaudi*. The Peruvian birds average somewhat larger, but the Peruvian series is larger and may show greater extremes; the measurements of the Brazilian birds are within the limits of the typical series.

Thus males from Perú measure as follows: wing, 68–79 mm. (av., 74.1); tail, 63–74 (av., 68.4); culmen from base, 11.75–15 (av., 13.5). Males from Teffé and Rosarinho measure: wing, 69.5–73 (av., 71.3); tail, 63–72.5 (av., 67.5); culmen from base, 12.5–14 (av., 13.1). Females from Perú: wing, 65–73 (av., 68.8); tail, 58–67.5 (av., 62.6); culmen from base, 12–14 (av., 12.9). Females from Teffé and Rosarinho: wing, 66–70 (av., 68); tail, 62; culmen from base, 12.6–13.5 (av., 12.9).

A single skin from Barão Melgaço, on the upper Gy-Paraná, flowing into the Madeira from the east, also is not greatly unlike the Peruvian birds, although the throat is of a more ochraceous, less cinnamonaceous, hue. This is a little surprising, in view of the fact that two skins from the valley of the Rio Roosevelt, a little to the eastward, are of a different sort and agree better with skins from the region between the lower Madeira and the Tapajoz. These, in turn, can not be referred to *castelnaudi* nor to *cuneatus*, having distinctive characters which are

not of an intermediate nature and which, therefore, suggest the description of a second new form from this region.

The lower Amazonian examples of *cuneatus* do not seem to be exactly like a single Bahian bird before me which, in turn, is quite comparable to the two cotypes of Wied's "*ruficaudus*" that probably also came from Bahia. The Amazonian specimens have larger bills and more of a buffy tinge on the throat, though the upper surface is less warmly colored. I suspect that *cuneatus* (*sensu lato*) is worthy of more study.

In Perú, *castelnaudi* has been recorded previously from La Gloria, Chayavitas, Chamicuros, Santa Maria, and Shanusi, near Yurimaguas, and from some of the localities given below in the list of specimens examined.

#### ***Glyphorhynchus spirurus albigularis* Chapman**

*Glyphorhynchus cuneatus albigularis* CHAPMAN, 1923 (August 28), Amer. Mus. Novitates, No. 86, p. 18—Mission San Antonio, Río Chimoré, Bolivia; ♂; American Mus. Nat. Hist.

The whitish chin and throat and narrow whitish spots on the breast, together with the generally dull coloration of upper and under parts, are sufficiently distinctive to mark this excellent form. The nearest taxonomic approach is found in the somewhat more warmly colored *cuneatus* of the Bahia-Pará region.

Peruvian records, not included in the material examined, are from Candamo, Yahuar Mayo, and Chaquimayo, all in the same general region of southeastern Perú.

#### ***Glyphorhynchus spirurus rufigularis*, new subspecies**

TYPE from Mt. Duida (Campamento del Medio), Venezuela; altitude 350 feet. No. 274,154, American Museum of Natural History. Adult male collected January 20, 1929, by the Olalla brothers.

DIAGNOSIS.—Similar to *G. s. castelnaudi* of northern Perú, but throat distinctly deeper rufous, less ochraceous; outer margins of remiges more rufescent in tone; general color of under parts browner, less tinged with olive; band across inner webs of remiges averaging darker ochraceous; size averaging smaller; bill averaging more slender.

Compared with *G. s. spirurus* of the Guianas, the new form lacks the grayish tint of the forehead and has the throat much less distinctly marked with dusky tips on the feathers, which average more deeply rufescent; dark margins of pectoral feathers less heavy; pale band across inner webs of remiges averaging darker.

RANGE.—Vicinity of Mt. Duida, Venezuela, ranging northeastward along the south bank of the Orinoco to the Río Caura, southeastward along the left bank of the Río Negro to Santa Isabel, Brazil, and on the right bank to near the mouth, westward to the eastern slopes of the eastern Andes in Colombia, and southwestward to portions of the upper Río Napo in Ecuador where it merges with *G. s. castelnaudi*.

DESCRIPTION OF TYPE.—Hind neck and mantle Argus Brown  $\times$  Brussels Brown; top of head somewhat duller and darker; anterior margin of forehead with shafts inconspicuously paler; rump and upper tail-coverts light Chestnut. Lores whitish with narrow dusky tips; a narrow buffy superciliary line present; auriculars brown with pale shafts; malar region brownish ochraceous, with shafts basally whitish; chin and throat somewhat more ruddy than clear Cinnamon-Rufous, with tips of feathers indistinctly dusky; breast dark Dresden Brown with sagittate shaft-spots of moderate width, pale buff; sides similar with reduced markings; flanks a little paler; belly pale Light Brownish Olive; under tail-coverts tinged with dark Sanford's Brown. Outer surface of primaries and secondaries near the color of the back; tertials light Chestnut; upper wing-coverts like the back; concealed portions of remiges sooty with a broad band (across the middle of the secondaries and all but the outer three primaries) light Cinnamon, formed by a triangular or quadrate spot on the inner webs of the respective quills, reaching the shaft only on the inner secondaries; a small stripe of similar color along the distal portion of the inner webs of the inner primaries and outer secondaries; under wing-coverts white with an ochraceous tinge at the tips, except for a dark brown area along the carpal margin, similarly tinged with ochre at the tips; axillars white with broad olive-brown tips. Tail light Chestnut. Maxilla (in dried skin) blackish; mandible dark horn-color; feet dark brown. Wing, 72 mm.; tail, 64; exposed culmen, 11; culmen from base, 13.75; tarsus, 16.5.

REMARKS.—Female similar but averaging smaller. Measurements of forty males show the wing, 68–74 mm. (av., 71.2); tail, 58.5–69 (av., 64.4); culmen from base (twenty males), 12–14.75 (av., 13). Twenty females measure: wing, 61–70 (av., 65.8); tail, 51.5–68.5 (av., 59.1); culmen from base (ten females), 12.75–13.75 (av., 13).

These measurements for both sexes average smaller than those of *castelnaudi* and particularly smaller than Peruvian examples of the latter form. Males from western Brazil, south of the Amazon, are about equal in size to the series of *ruficularis*, though the few females available from that region are larger than the average of the same sex of *ruficularis*. The measurements of *castelnaudi* are given in the discussion of that form.

The rufous throat of the present form is a character best appreciated in an examination of series rather than of single birds, as is the browner coloration of the lower under parts. Single specimens may prove to be puzzling, since the palest extremes of *ruficularis* (or specimens in which the color of the throat has been diluted by stretching the skin of the region) may approach the darkest examples of *castelnaudi*, but these cases are uncommon. Most examples may be separated quite easily.

Skins from the Amazonian slopes of the eastern Andes of Colombia have the throat at the maximum of deep reddish coloration, though this area is inclined to be a little more decidedly marked with dusky speckling at the tips of the feathers. Also the pale spots on the breast average a

little larger. This tendency (aside from the deep coloration) is, apparently, in the direction of *sublestus*, which occupies the interior valleys and western coast of Colombia. One male from La Morelia, in fact, is especially suggestive of *sublestus*, though the throat is more deeply colored than in that form. A female from La Morelia is less like *sublestus*.

Incidentally, four specimens from Nicaragua show the transition between *sublestus* and *pectoralis*, though the number of specimens is not great enough to warrant their precise allocation nor the definitions of ranges in that country.

Specimens from the upper regions of the Río Napo in Ecuador are the most difficult to place. A few examples from the lower Napo are quite comparable to Peruvian birds and three skins from below San José are likewise closest to that form. One male from the lower Río Suno may be matched in the Peruvian series, but two females from the same given locality (though collected on different dates) and three males and two females from the upper Suno, above Avila, are all decidedly closer to *rufigularis*, though they are not quite typical. A male and a female from the lower slopes of Mt. Sumaco, nearby, show some inclination toward *sublestus* of the western slopes of the Andes, though they are far from typical of that subspecies. Evidently the three forms have their ranges meeting in this general region and the proper delimitation of each must await good series from many different localities thereabouts.

#### ***Glyphorhynchus spirurus inornatus*, new subspecies**

TYPE from Lago Andirá, Villa Bella Imperatriz, south bank of the Río Amazonas, Brazil. No. 278,030, American Museum of Natural History. Adult male collected September 15, 1930, by the Olalla brothers.

DIAGNOSIS.—Similar to *G. s. castelnaudi* of northern Perú, but pale markings on breast confined to the upper portion where they are much reduced in size and somewhat more deeply buff; feathers of chin and throat more broadly and evenly margined terminally, and with these margins browner, less blackish; general color of under parts browner, less olive. The brownish ventral color is matched by some *rufigularis* which has deeper rufous, less margined throat-feathers and broader pectoral markings, and also has paler wings and tail; *spirurus* has a paler general color, a much more broadly spotted breast with darker margins, more dusky margins on the throat, a grayish forehead, and broader superciliaries; *cuneatus* has a paler throat, a lighter back, broader pectoral spots, and broader superciliaries; *albicularis* has a much whiter throat, whiter pectoral markings, and a much paler general color; *pectoralis* and *sublestus* have much coarser markings.

RANGE.—South bank of lower Amazon from the left bank of the Tapajoz to the right bank of the Madeira, extending up the latter and its lower tributaries to include the Río Roosevelt.

DESCRIPTION OF TYPE.—Mantle Amber Brown × Argus Brown; top of head darker; rump and upper tail-coverts light Chestnut; lores with pale buffy centers and

dusky tips; a narrow superciliary line of deep buff from lores to sides of occiput; auriculars dusky brown with buffy shafts on lower portion; malar region spotted in appearance, with dark brown margins and small shaft-spots of buff; chin and throat Clay Color with relatively broad even margins of the color of the breast; breast warm Dresden Brown, unmarked on lower portion and on sides but with upper portion varied by relatively small, sagittate shaft-spots of light buff; flanks a little lighter than sides; belly still paler, unmarked; under tail-coverts tinged with deep Cinnamon, at least distally, and with pale shafts. Wings externally near Auburn; concealed portions sooty with a light Cinnamon-Buff band formed by a triangular or quadrate patch on the inner margins of the inner webs of all the primaries except the outer three and on all the secondaries, evanescent on the inner ones; upper wing-coverts Auburn  $\times$  Argus Brown; under wing-coverts and axillars white but with a brownish area along the carpal margin. Tail, Bay; maxilla blackish (in dried skin); mandible pale grayish horn-color; feet dull blackish. Wing, 66.5 mm.; tail, 65; exposed culmen, 11.5; culmen from base, 13; tarsus, 16.

REMARKS.—Females similar to the males; no difference in size between the sexes demonstrable at present. The males of the series at hand measure: wing, 66.5–72 mm. (av., 68.6); tail, 62–70 (av., 65.9); culmen from base, 12.75–14 (av., 13.2). The single topotypical female has the wing, 68.5 mm.; tail, 65; culmen from base, 14.

There is some variation in the coloration of the upper parts, as there is in the other members of the group. The type is one of the more richly colored examples in this respect. On the under side, however, there is little variation and the broad, evenly colored, relatively light-hued, terminal margins of the ochraceous throat-feathers, the unstreaked brownish belly, and the but moderately spotted chest are features not found, at least in combination, in other forms of the species.

A male from "Camp 8," Rio Roosevelt, and a female from Morinha Lyra are closer to *inornatus* than to other forms and are best referred to it for the present. A third female from Barão Melgaço, on the Gy-Paraná, is quite distinct. It has been discussed in more detail under *castelnaudi*.

#### SPECIMENS EXAMINED

*G. s. spirurus*.—FRENCH GUIANA: Cayenne, 1 (?); Ipousin, 2 ♂, 1 ♀. DUTCH GUIANA: Paramaribo, 1 ♂. BRITISH GUIANA: Kamakusa, 3 ♂, 1 ♀ (?); Tumatumari, 3 ♂, 1 ♂ (?), 7 ♀; Minnehaha Creek, 1 ♂, 1 ♀; Potaro Landing, 7 ♂, 2 ♀; Tukeit, 1 ♂; (no locality), 1 (?). BRAZIL: Faro (San José), 4 ♂, 3 ♀; (Boca Rio Paratucú), 2 ♂; (Castanhal), 4 ♂; (Serra do Espelho), 1 ♀.

*G. s. ruficularis*.—VENEZUELA: Mt. Duida, Campamento del Medio, 3 ♂ (incl. type); Playa del Río Base, 4 ♂, 3 ♀; Caño León, 4 ♂; Río Pescada, 1 ♂; Caño Seco, 3 ♂; Valle de los Monos, 2 ♀; Foothills Camp, 3 ♂, 1 ♀; (western) foot of Mt. Duida, 3 ♀; Esmeralda, 1 ♂, 3 ♀; Río Cassiquiare, El Mery, 4 ♀; opposite El Mery, 8 ♂, 3 ♀; Solano, 2 ♂, 2 ♀; Buena Vista, 1 ♀; Río Orinoco, mouth of Río Ocamo, 8 ♂, 7 ♀; opposite mouth of Río Ocamo, 4 ♂, 1 ♀; Suapure, 1 ♂, 1 ♀;

Río Caura, La Unión, 3 ♂; Río Cunucunumá, Boca de Sina, 1 ♀. COLOMBIA: Río Uaupés, opposite Tahuapunto, 1 ♀; "Bogotá," 1 (?); Florencia, 2 ♂, 1 ♀; Villavicencio, 1 ♂; La Morelia, 1 ♂, 1 ♀. BRAZIL: Río Uaupés, Tahuapunto, 8 ♂, 6 ♀; Ipanarete, 1 ♂; Río Negro, Tatú, 7 ♂, 3 ♀; Santa Isabel, 1 ♂; Yucabi, 4 ♂; Tabocal, 1 ♂; Tinahy, 1 ♂; San Gabriel, 1 ♂; Mt. Curucuryari (500-1800 ft.), 4 ♂, 5 ♀, 1 (?); Muirapinima, 1 ♂, 3 ♀. ECUADOR: Río Suno, above Avila, 3 ♂, 2 ♀; lower Río Suno, 2 ♀.

*G. s. castelnaudi*.—PERÚ: Pebas, 1 ♂; Anayacu, 1 ♂; Puerto Indiana, 3 ♂, 2 ♀; Orosa, 5 ♂, 4 ♀; Sarayacu, 2 ♀; Lagarto, Río Ucayali, 7 ♂, 3 ♀; Santa Rosa, 5 ♂, 1 ♀; Puerto Bermúdez, 1 ♂<sup>1</sup>, 3 ♀<sup>1</sup>; Chanchamayo, 1 ♀<sup>1</sup>; La Merced, 1 ♀; Tulumayo, 1 ♂, 1 ♀; Río Seco, west of Moyobamba, 1 ♀, 1 (?). ECUADOR: mouth of Lagarto Cocha, 1 ♂; mouth of Río Curaray, 3 ♂, lower Río Suno, 1 ♂; below San José, 2 ♂, 1 ♀. BRAZIL: Teffé, 4 ♂, 1 ♀; Río Madeira, Rosarinho, 6 ♂, 3 ♀, 2 (?); Barão Melgaço, 1 ♀.

*G. s. albicularis*.—BOLIVIA: Mission San Antonio, 1 ♂ (type); mouth of Río San Antonio, 1 ♂; Tres Arroyos, 1 ♂. PERÚ: Río Távora, 1 ♂; Río Inambari, 2 ♂, 1 ♀; La Pampa, 1 ♂, 1 ♀; Astillero, 1 ♀.

*G. s. inornatus*.—BRAZIL: Río Madeira, Igarapé Auará, 1 ♂; Río Amazonas, Villa Bella Imperatriz (Lago Andirá), 5 ♂ (incl. type), 1 ♀; (Boca Río Andirá), 2 ♂; Río Tapajoz (left bank), Igarapé Brabo, 1 ♀; Río Roosevelt, "Camp 8" (6th of March Rapids), 1 ♂; Morinha Lyra, 1 ♀.

*G. s. cuneatus*.—BRAZIL: "Bahia," 1 (?); "Brasília," 1 ♂, 1 ♀ (cotypes of "*ruficaudus*"); Utinga, near Pará, 2 ♂, 1 ♀; Peixe Boi, 1 ♀; Río Tocantins, Mocajuba, 1 ♂, 2 ♀; Baião, 4 ♂, 2 ♀, 1 (?); Río Xingú, Villarinho do Monte, 4 ♂, 3 ♀, 1 (?); Porto de Moz, 1 ♀; Río Tapajoz (right bank), Santarem, 2 (?); Caxiricatuba, 1 ♂, 1 ♀; Tauary, 2 ♂; Ilha de Coata, 1 ♀.

*G. s. sublestus*.—ECUADOR: Mindo, 2 ♂, 1 ♀; La Chonta, 1 ♂; Gualea, 1 ♀; Río de Oro, 1 ♀, 1 (?); Cerro Manglar Alto, 1 ♀; lower Sumaco, 1 ♂<sup>2</sup>, 1 ♀<sup>2</sup>. COLOMBIA: Choco, 1 ♀; San José, 1 ♂, 2 ♀; Noanamá, 1 ♂; Barbacoas, 3 ♂; Buenavista, Narino, 1 ♀, 1 (?); Alto Bonito, 2 ♂, 1 ♀; Puerto Valdivia, 1 ♀; Gallera, 2 ♀; Cocal, 1 ♂; Río Salaquí, 1 ♀. PANAMÁ: Boca de Cupe, 1 ♂, 1 ♀; east slope of Mt. Tacarcuna, 2 ♂, 1 ♀, 1 (?); El Real, Río Tuyra, 3 ♂, 3 ♀; (Lion Hill), 1 ♂, 1 ♀. COSTA RICA: (no locality), 1 ♂; Reventazón, 1 ♀; Bonilla, 1 ♂; Río Matina, 2 ♂<sup>1</sup>; Palmar, 1 (?).<sup>1</sup>

*G. s. pectoralis*.—GUATEMALA: (no locality), 9 (?).<sup>1</sup> Los Amates, 1 ♂<sup>1</sup>. MEXICO: Tolosa, 1 ♀.

*G. s. pectoralis* × *sublestus*.—NICARAGUA: Río Tuma, 1 ♀; Tuma, 1 ♀; Los Sabalos, 1 ♂, 2 ♀.

### *Sittasomus griseicapillus aequatorialis* Ridgway

*Sittasomus aequatorialis* RIDGWAY, "1891" = 1892, Proc. U. S. Nat. Mus., XIV, p. 509—Guayaquil, Ecuador; U. S. Nat. Mus.

A small series of seven birds from the Pacific side of the Andes in northwestern Perú is easily identifiable as belonging to the west-Ecuadorian subspecies, hitherto recorded from Lechugal in the same region.

<sup>1</sup>Specimens in Field Museum of Natural History, Chicago.

<sup>2</sup>Not typical.



**Sittasomus griseicapillus amazonus Lafresnaye**

*Sittasomus Amazonus* LAFRESNAYE, 1850, Rev. Mag. Zool., (2) II, p. 590—  
Upper Amazon, Castelnau Expedition = Peruvian Amazon; Paris Mus.

Sixteen birds from various localities in Perú, east of the western range, show no striking differences among themselves, though there is some variation of an individual nature. Thus, the light-colored band across the inner webs of the remiges is sometimes strongly ochraceous buff and sometimes nearly white, though the under wing-coverts and axillars are regularly whitish, without much buffy tinge. The lower mantle is warm brown, sometimes overlaid with an ashy grayish tone at the tips of the feathers, but the anterior portion of the mantle usually shows a more decided and darker gray or olive-gray hue like the hind neck and the top of the head.

Records from Perú assignable to *amazonus* are from Garita del Sol, San Emilio, Monterico, Amable Maria, Ropaybamba, Yurimaguas, Huambo, and upper Ucayali, in addition to Huachipa from which material has been examined.

East-Ecuadorian birds are comparable to the Peruvian series and show no appreciable differences. Skins from the left bank of the Rio Negro, Brazil, from near the mouth to the source, and also from the western side of the Cassiquiare, are hardly distinguishable from Peruvian birds. Possibly the top of the head averages a little grayer and less olive-tinged and the band across the remiges more decidedly whitish, but some examples are indistinguishable.

Similarly, skins from both banks of the lower Madeira, the left bank of the Tapajoz, the region of the Amazon between the Tapajoz and the Madeira, and the right bank of the Xingú are quite like Peruvian birds, without any decided ochraceous color on the axillars and under wing-coverts though with some variation in the color of the wing-band. Traces of buff on the coverts and axillars are developed in several skins from northern Matto Grosso, in a region approaching the range of *griseicapillus* which has a quite deeply colored wing-lining. On the other hand, skins from the right bank of the lower Tapajoz have decidedly ochraceous coloring beneath the wing and on the wing-band, agreeing closely with skins from Faro and from Mt. Roraima in this respect. So constant and noticeable is this difference north of the Amazon, that the form thus marked is worthy of recognition. Accordingly, it may be known as follows.

***Sittasomus griseicapillus axillaris*, new subspecies**

TYPE from São José, near Faro, Rio Jamundá, Brazil. No. 284,025, American Museum of Natural History. Adult male collected January 10, 1931, by the Olalla brothers.

DIAGNOSIS.—Similar to *S. g. amazonus* of Perú, but axillars and under wing-coverts distinctly ochraceous instead of whitish; outer margins of outer remiges more rufescent; upper mantle more strongly rufescent; size slightly smaller.

RANGE.—North bank of the Amazon at Faro, ranging northward at least to the vicinity of Mt. Roraima and crossing the Amazon to the south bank in a limited area on the right bank of the Tapajoz.

DESCRIPTION OF TYPE.—Top of head Dark Grayish Olive; mantle warm Brussels Brown, clearer on lower portion; rump and upper tail-coverts dark Sanford's Brown. Lores and sides of head a little paler and grayer than the crown; breast and sides lighter than Deep Grayish Olive; chin and throat still lighter; belly tinged with buff; flanks washed with brown at the tip; under tail-coverts bright Hazel. Primaries and secondaries largely blackish; a broad band of Pinkish Buff across the middle or sub-basal portion of the wing formed by a triangular or squarish patch on the inner webs of the quills from the fourth primary (from the outside) to the innermost secondary; outer margins of primaries Sayal Brown to Cinnamon-Rufous; tertials and outer margins of inner secondaries Ferruginous X Hazel; an ochraceous spot on the inner webs of the inner primaries near the tips, deepening in color and crossing the shafts on the secondaries to form a broad rufous terminal band; the blackish ground-color of the remiges reaches the outer margins on the inner primaries and outer secondaries, forming a blackish patch visible on the closed wing; axillaries and under wing-coverts largely Ochraceous-Buff; lesser upper wing-coverts like mantle; median and greater series fuscous, with outer margins like the back. Maxilla (in dried skin) brownish black; mandible pale; feet dull brownish. Wing, 85.5 mm.; tail, 79; exposed culmen, 13.5; culmen from base, 18; tarsus, 17.5.

REMARKS.—Females like the males but smaller. Wings, 70–78 mm.; tail, 68–79; culmen from base, 16.5–18; tarsus, 15.5–16.5. The males measure: wings, 76–87 mm.; tail, 73–82; culmen from base, 16.5–18.5; tarsus, 16–18.5.

The Faro and Roraima birds are quite uniform in the decided ochraceous color of the under wing-coverts, axillaries, and wing-bar. The bright color of the outer margins of the remiges is subject to little variation, though the dusky patch, visible on the closed wings of numerous skins, including the type, is sometimes withdrawn from the extreme margin which is then colored like the rest of the marginal area.

The birds from the right bank of the lower Tapajoz probably are referable to *axillaris*. The axillars, under wing-coverts, and wing-band are certainly more ochraceous than those of the birds from the east and west, though some of them are not so strongly marked as the Faro and Roraima birds. The other characters also show an approach toward *axillaris*. Apparently there is a contact between this area and the

range of *axillaris*, north of the Amazon, that is not existent at other places.

I have seen no skins from the Guianas nor from Manaus and did not note the characters of *axillaris* in a skin from the Rio Branco examined several years ago. Nevertheless, I would expect the range of *axillaris* to include these outlying regions. The record from Suapure, Rio Caura, Venezuela, is of doubtful reference and must await examination of the specimens.

#### SPECIMENS EXAMINED

*S. g. aequatorialis*.—ECUADOR: Guayaquil, 1 "♂" = ♀; Chongocito, 2 ♂, 1 ♀; Alamor, 3 ♂, 1 ♀; Pullango, 2 ♂; Guainche, 1 ♂; Chone, 1 ♂, 1 ♀; Casanga, Almendral, 1 ♂; Santa Rosa, 1 ♂, 1 ♀; Cebollal, 2 ♂; Babahoyo, 1 "♂" = ♀. PERÚ: Palambla, 1 ♂, 1 ♀; Paletillas, 1 ♂, 1 ♀; Milagros, 2 ♂, 1 ♀.

*S. g. amazonus*.—PERÚ: Río Távora, 1 ♀; mouth of Río Urubamba, 1 ♂; Lagarto, upper Ucayali, 2 ♂, 2 ♀; Huachipa, 1 ♂<sup>1</sup>, 1 ♀<sup>1</sup>; Uchco, 1 ♂; Río Seco, west of Moyobamba, 1 ♀; Jaen, 1 ♂; Perico, 3 ♂, 2 ♀; Lomo Santo, 1 ♂, 1 ♀. ECUADOR: Río Suno, above Avila, 1 ♂; mouth of Río Curaray, 2 ♂, 1 ♀; Zamora, 3 ♀. VENEZUELA: Río Huayña, junction with Río Cassiquiare, 2 ♂, 2 ♀. COLOMBIA: Río Uaupés, opposite Tahuapunto, 1 ♂. BRAZIL: Rio Negro, Mt. Curycuryari, 1 ♂; Yavanari, 1 ♂; Yucabi, 1 ♀; Igarapé Cacao Pereira, 1 ♂; Matto Grosso, Monte Cristo, 1 ♂; Vilhena, 1 ♂; Utiarity, 1 ♂; Rio Roosevelt, Infernas Rapids, 1 ♀; Rio Madeira, Rosarinho, 2 ♂; Borba, 1 ♂, 1 ♀; Igarapé Auará, 2 ♂; Rio Amazonas, Villa Bella Imperatriz, 3 ♂; Rio Tapajoz (left bank), Boim, 1 ♂; Igarapé, Brabo, 4 ♂, 3 ♀; Igarapé Amorin, 1 ♂, 1 ♀; Limoal, 1 ♂; Rio Xingú, Tapará, 6 ♂, 1 ♀.

*S. g. axillaris*.—BRAZIL: Faro, 1 ♂; Faro (Castanhal), 5 ♂, 1 ♀; (São José), 5 ♂ (incl. type), 1 ♀; (Boca Rio Paratucú), 1 ♂; (Serra do Espelho), 1 ♂; Rio Tapajoz (right bank), Aramanay, 1 ♂; Caxiricatuba, 2 ♂; Piquiatuba, 1 ♂; Tauarý, 1 ♂, 3 ♀. VENEZUELA: Mt. Roraima, Paulo, 1 ♂, 2 ♀; Arabupu, 2 ♂, 1 ♀.

#### *Deconychura longicauda connectens* Zimmer

*Deconychura longicauda connectens* ZIMMER, 1929 (May 18), Field Mus. Nat. Hist. Publ., Zool. Ser., XVII (1), p. 8—Puerto Bermúdez, Río Pichis, Perú; ♂; Field Mus. Nat. Hist.

A specimen from Pomará adds another locality to the known range of the form in Perú, and five examples from Mt. Duida, the Cassiquiare, and the right bank of the upper Rio Negro carry the range northeastward for a considerable distance.

These six birds agree fairly well among themselves, but two examples from eastern Ecuador, about which I have commented in an earlier paper (1929, Field Mus. Nat. Hist. Publ., Zool. Ser., XVII (1), p. 10), are distinctly darker above and more olivaceous below, with the

<sup>1</sup>Specimens in Field Museum of Natural History, Chicago.

pectoral markings larger and the belly more distinctly marked with pale spots. In fact, as noted in my earlier paper, these birds are somewhat closer to *typica* of Costa Rica in general appearance, though a little larger. The pronounced streaking on the top of the head, however, is a point of resemblance to *connectens*, which is of similar size. In view of the intermediate character of these Ecuadorian birds, a larger series will be required to determine their correct assignment.

***Deconychura longicauda pallida* Zimmer**

*Deconychura longicauda pallida* ZIMMER, 1929, Field Mus. Nat. Hist. Publ., Zool. Ser., XVII (1), p. 6—Hyutanahan, Rio Purús, Brazil; ♂; Carnegie Mus.

A female from Astillero, southeastern Perú, belongs to this relatively dull-colored form and constitutes the first record of it from Perú.

A small series of eight skins, from as many distinct localities in Brazil south of the Amazon, shows considerable variation in color, and no two of the skins are exactly alike. A male from the left bank of the Rio Madeira is rather richly colored and very close to *connectens*, though the brown margins of the pectoral spots are not quite so dark. A bird without given sex, from the upper Rio Roosevelt, is distinctly browner with a more deeply colored throat and may represent an unknown form. A male from the right bank of the lower Madeira is duller than the left-bank example, while a female from the left bank of the Tapajoz is intermediate between the other two. A male from Villa Bella Imperatriz, geographically between the Madeira and the Tapajoz, is darker and more olivaceous, and approaches a specimen of *longicauda* from Faro, north of the Amazon. The female from Astillero, Perú, is very like the bird from the right bank of the Madeira, though very slightly paler and duller. A male from Teffé is still paler, though of the same general style of coloration.

A male from the Rio Iriri and a male from the right bank of the Xingú are whiter on the throat than any of the others mentioned; the Xingú bird, furthermore, has the pectoral spots decidedly broader, whereas the Iriri skin has the under tail-coverts unusually strongly rufescent. Birds from the region between the right bank of the Tapajoz and the Pará district were noted in my earlier paper (*tom. cit.*, p. 8) as having whitish throats, but one of them was found to have the ventral markings unusually linear, just the opposite of the present Xingú example. A good series from this region is needed to determine the constancy of the whitish throat, though it appears to be of some stability.

SPECIMENS EXAMINED<sup>1</sup>

*D. l. longicauda*.—BRAZIL: Faro, 1 ♂.

*D. l. pallida*.—BRAZIL: Rio Xingú, Porto de Moz, 1 ♂; Rio Iriri, Bocca de Curuá, 1 ♂; Rio Tapajoz (left bank), Igarapé Brabo, 1 ♀; Rio Amazonas, Villa Bella Imperatriz, 1 ♂; Rio Madeira (right bank), Igarapé Auará, 1 ♂; (left bank), Sto. Antonio de Guajará, 1 ♂; Teffé, 1 ♂; Rio Roosevelt, [6th of March Rapids]<sup>2</sup>, 1 (?). PERÚ: Astillero, 1 ♀.

*D. l. connectens*.—PERÚ: Pomará, 1 ♀. ECUADOR: Sabanilla, 1 ♂<sup>2</sup>; Cutucuo, 1 [♀]<sup>2</sup>. BRAZIL: Rio Negro, Mt. Curucuryari, 1 ♂; Tatú, 1 ♀; Rio Uaupés, Tahuapunto, 1 ♀. VENEZUELA: Río Cassiquiare, Solano, 1 ♀; Río Huayná, 1 ♀; Mt. Duida, Esmeralda, 1 ♀.

*D. l. typica*.—PANAMÁ: Almirante, 1 ♂; Río Calovévora, 1 ♀. COSTA RICA: El Pozo de Terraba, 1 ♂; Hacienda La Iberia, 1 ♂; Puerto Jimenez, 1 ♂, 1 ♀; Volcan (de Aso), 1 ♂.

***Deconychura stictolasma secunda* Hellmayr**

*Deconychura secunda* HELLMAYR, 1904, Bull. Brit. Orn., Club, XIV, p. 51—Río Coca, upper Río Napo, eastern Ecuador; "♀" = ♂; Rothschild collection, American Mus. Nat. Hist.

I have not yet been able to examine the type of this form but a number of additional specimens from Perú and western Brazil confirm my earlier conclusions about the identity of this bird [1929, Field Mus. Nat. Hist. Publ., Zool. Ser., XVII (1), p. 15]. In conformity with the distributional pattern of various other species of the Dendrocolaptidae, the Peruvian form ranges through eastern Ecuador to the upper Rio Negro, Brazil, and the region of Mt. Duida. One skin from Tabocal and one from Mt. Duida agree with the Peruvian birds in the relatively rufescent back, brownish head, deeply colored uropygium, wings, tail, and under tail-coverts. Four birds from Teffé, south of the Amazon, carry the range eastward beyond the Juruá. The variations in the series of eight birds now before me reduce the probability that the birds from the lower Purús belong to a distinct subspecies, as I once (*tom. cit.*, p. 17) suspected; they probably belong to the present form. Recorded in Perú only from Chamicuro and Puerto Bermúdez.

SPECIMENS EXAMINED<sup>3</sup>

*D. s. stictolaema*.—BRAZIL: Rio Madeira (right bank), Igarapé Auará, 1 ♀; Rio Amazonas, Villa Bella Imperatriz, 1 ♂, 2 ♀; Rio Tocantins, 1 [♀].

*D. s. clarior*.—BRAZIL: Faro, 1 ♂.

*D. s. secunda*.—BRAZIL: Teffé, 2 ♂, 2 ♀; Rio Negro, Tabocal, 1 ♀. VENEZUELA: Mt. Duida, Valle de los Monos, 1 ♀. PERÚ: Puerto Indiana, 1 ♂; Anayacu, 1 ♀; Pomará, 1 (? = ♂).

<sup>1</sup>Excluding those listed in my review of the genus (*tom. cit.*, pp. 17, 18) and not since reexamined.

<sup>2</sup>Not typical.

<sup>3</sup>Excluding those listed in my review of the genus (*tom. cit.*, p. 18).

**Margarornis squamigera squamigera** (D'Orbigny and Lafresnaye)

*A (nabates) squamiger* D'ORBIGNY AND LAFRESNAYE, 1838, Mag. Zool., VIII, Cl. II, p. 14—Ayupaya, rep. Bolivia—near Palca, Prov. Ayopaya, Bolivia); Mus. Comp. Zool., Cambridge.

The only record of the typical subspecies from Perú is that of a female from Limbani, in Field Museum of Natural History, Chicago.

**Margarornis squamigera peruviana** Cory

*Margarornis perlata peruviana* CORY, 1913, Field Mus. Nat. Hist. Publ., Orn. Ser., I, p. 291—Tambo Ventija, ten miles east of Molinopampa, Perú; ♂; Field Mus. Nat. Hist.

Examination of a fairly large series of Peruvian, Ecuadorian, and Colombian specimens confirms my belief in the validity of the central Peruvian subspecies although, it must be admitted, occasional specimens defy the rules and show considerable resemblance to *perlata*.

Taken as a series, the central Peruvian birds are decidedly more yellowish on throat, superciliary stripe, and the spots of the breast and lower under parts, and rarely does a specimen from the northern countries show a depth of color approaching the average of the central Peruvian examples; none of the latter is as whitish as the extremes of *perlata* although some specimens are like the more yellowish skins of that form. A specimen of this sort is a male from Cedrobamba, Urubamba Valley, which is less yellowish below and on the superciliary line than some extreme northern examples, but the bird is in molt and some of the new feathers are a little brighter in color. A female from the same locality is paler than normal, and not so deeply yellowish as typical *peruvianus*, but is brighter yellow than many Ecuadorian and Colombian specimens. Carriker has recorded two skins from Huacapistana and three from Auquimarca which are said to be similar to Ecuadorian and Colombian birds, but four specimens now before me from Maraynioc and Rumicruz, in the same general region, are brighter yellow than the brightest bird I have from the northern countries. The light-colored examples from central Perú must, therefore, represent the extreme of individual variation in a form which, obviously, is not perfectly constant.

One characteristic of a little diagnostic value may be mentioned. In *perlata*, the spots on the belly are inclined to be wider than in *peruviana* (the entire feather appears to be wider), and though some of the skins of *perlata* have these marks relatively narrow, none of eleven skins of *peruviana* examined in this particular reference has them so broad, except one immature specimen which, like the juvenals of *perlata*, has the ventral markings more coarsely developed than in the adults of the

respective form. The criterion is not safe for unrestricted usage but is helpful as an adjunct.

Records from Perú which belong to *peruviana* are from Cutervo, Tamiapampa, Atuén, Huacapistana, and Auquimarca, together with the localities from which material has been examined.

***Margarornis squamigera perlata* (Lesson)**

*Sittasomus perlatus* LESSON, 1844 (August 11), Echo du Monde Savant, XI, No. 12, p. 275—Colombia.

Two males and two females from El Tambo, above Palambla, Perú, are very decidedly referable to the Ecuadorian-Colombian form. One female from Palambla and a male from Taulis, both localities on the western side of the western Andes, are more yellowish, not so deeply tinted as normal central Peruvian birds but matched by the brightest examples from farther north. The abdominal spots are very broad in all of these, agreeing with many of the northern birds but exceeding any adults of *peruviana*. Obviously, *perlata* extends down the western side of the western Andes from its recorded range in the adjacent parts of Ecuador and Colombia, but is kept from connection with *peruviana* by the arid cañon of the Marañón.

There are no other Peruvian records.

**SPECIMENS EXAMINED**

*M. s. squamigera*.—BOLIVIA: Incachaca, 3 ♀; Cocapata, 1 (?) ; Río Aceramarca, 1 ♂, 1 ♀. PERÚ: Limbani, 1 ♀<sup>1</sup>.

*M. s. peruviana*.—PERÚ: Tambo Ventija, 3 ♂<sup>1</sup> (incl. type), 4 ♀; La Lejia, north of Chachapoyas, 4 ♂, 2 ♀; mountains near Panao, 3 ♂<sup>1</sup>, 3 ♀<sup>1</sup>; Rumicruz, Junín, 1 ♂, 1 (?) ; Maraynioc, 2 ♂, 1 (?)<sup>2</sup>; Cedrobamba, 1 ♂, 1 ♂<sup>2</sup>, 1 ♀; Torontoy, 1 ♀<sup>2</sup>.

*M. s. perlata*.—PERÚ: El Tambo, 2 ♂, 2 ♀; Taulis, 1 ♂; Palambla, 1 ♀. ECUADOR: near Quito, 1 (?) ; Macas region, 1 (?) , Oyacachi, 2 ♂, 2 ♀; upper Sumaco, 2 ♂, 1 ♀; above Baeza, 1 ♂; Baeza, 2 ♂, 1 ♀; Asilan, Río Upano, 1 (?) ; Taraguacocha, 1 ♂, 1 (?) ; El Chiral, 1 ♂; Salvias, 1 ♂; above Papallacta, 1 ♀. COLOMBIA: Almaguer, 1 ♂, 1 ♀, 1 ♂<sup>1</sup>, 1 ♀<sup>1</sup>, 1 ♂<sup>2</sup>; Cerro Munchique, 2 ♂, 1 ♀, 2 (?) , 1 ♀<sup>2</sup>; Valle de los Pappas, 1 ♂, 2 ♀, 1 ♂<sup>2</sup>, 1 ♀<sup>2</sup>; Laguneta, 4 ♂; Santa Isabel, 1 ♂, 2 ♀, 1 ♂<sup>2</sup>; El Piñon, 1 ♂, 1 ♀; "Bogotá," 2 ♂<sup>1</sup>, 1 ♀<sup>1</sup>, 1 ♀<sup>2</sup>. VENEZUELA: Nevados, 1 ♀; Conejos, 1 ♂; Valle, 1 ♂; Sinor, 1 ♂; Culata, 1 ♂<sup>2</sup>, 1 ♀<sup>2</sup>.

***Premnornis guttuligera* (Sclater)**

*Thripophaga guttuligera* SCLATER, 1864, P. Z. S. London, p. 167—in Nova Granada interiore=Bogotá, Colombia; British Mus.

*Margarornis guttata* LAWRENCE, "1865 (May)"=1867, Ann. Lyc. Nat. Hist. N. Y., VIII, p. 128—Quito, Ecuador.

<sup>1</sup>Specimens in Field Museum of Natural History, Chicago.

<sup>2</sup>Specimens in U. S. National Museum, Washington.

Hitherto recorded from Perú only from the Urubamba Valley. Several additional skins from other localities are now at hand and show a probable line of connection along the Central Andes, broken by the cañon of the Marañón, without the differentiation of any subspecies.

SPECIMENS EXAMINED

*P. guttuligera*.—COLOMBIA: Anolaima, 1 ♂; Aguadita, 1 ♂; Subia, 1 ♂; San Antonio, 1 ♂, 2 ♀; La Palma, 1 ♂; Bogotá region (Choachi, Cunday, El Badio), 3 (?). ECUADOR: Quito, 1 (?) (type of *guttata*); lower Sumaco, 2 ♂, 3 ♀; Baeza, 1 ♂, 1 ♀; below Baeza, 1 ♀; Sabanilla, 1 (?). PERÚ: Chaupe, 1 ♂, 1 ♀; La Lejía, 1 ♂; Chelpe, 1 ♀; Idma, 1 ♂.

*Premnoplex brunnescens brunnescens* (Sclater)

*Margarornis brunnescens* SCLATER, 1856, P. Z. S. London, XXV, p. 27, Pl. CVI—Bogotá; British Mus.

The typical subspecies is relatively variable and throughout its known range in Colombia, Ecuador, and northern Perú shows no localized differentiation. Some skins are quite richly colored and others are paler with a variable amount of light-colored shaft-streaks on the mantle, never very prominently developed. The paler skins are more inclined to show this obsolete streaking than the more richly colored examples. Some specimens, such as three from the Macas region of eastern Ecuador, are particularly deeply colored, but they are matched by other birds from Gallera, Colombia, and lower Sumaco, Ecuador, while still others from various localities show every degree of intergradation between these extremes and the pale opposites. Pale spots near the tips of the upper wing-coverts appear irregularly in examples of all degrees of coloration.

Except for the specimens listed below, the only Peruvian record is from Huambo.

*Premnoplex brunnescens stictonotus* (Berlepsch)

*Margarornis stictonota* BERLEPSCH, 1901, Jour. für Orn., XLIX, p. 95—Chaco, Yungas of La Paz, Bolivia; ♂; Berlepsch Coll., Frankfurt Mus.

A male from Santo Domingo and another of the same sex from below Limbani, southeastern Perú, add two localities to the meager Peruvian records of this form. Previously, four females from Huaynapata, noted by Berlepsch and Stolzmann, furnished the sole evidence of the occurrence in this country.

The two birds in hand agree in general respects with a male from Locotal and a female from Roquefalta, Bolivia, though there is much variation in the tone of coloration. The Roquefalta female is the deepest



hued. Apparently there exists the same degree of variation that occurs in *brunnescens*.

#### SPECIMENS EXAMINED

*P. b. brunnescens*.—COLOMBIA: east of Palmira, 2 ♂; San Antonio, 1 ♀, 1 (?); Gallera, 1 (?); Aguadita, 1 ♂; Salento, 1 (?); El Roble, 1 ♂; "Cauca," 1 (?); Cerro Munchique, 1 ♂; Salvias, 1 ♀; Cocal, 1 ♂<sup>1</sup>, 1 (?); Bogotá, 1 ♂<sup>1</sup>; La Florida, 1 ♂<sup>1</sup>. ECUADOR: lower Sumaco, 7 ♂, 3 ♀; below San José, 4 ♂, 2 ♀; Mindo, 2 ♂, 1 ♀; below Mindo, 1 ♂; Zaruma, 2 ♂, 1 ♀, 1 (?); below Baeza, 1 ♀; Macas region, 1 ♂, 2 (?); Zamora, 1 ♂; El Chiral, 2 ♂, 1 ♀. PERÚ: La Lejía, 1 ♂, 1 ♀; Huachipa, 1 ♂<sup>1</sup>; Vista Alegre, 1 ♂<sup>1</sup>.

*P. b. stictonotus*.—BOLIVIA: Locotal, 1 ♂; Roquefaldá, 1 ♀; Yungas of Cochabamba, 1 ♂<sup>2</sup>. PERÚ: Santo Domingo, 1 ♂; below Limbani, 1 ♂.

#### *Sclerurus albigularis zamorae* Chapman

*Sclerurus albigularis zamorae* CHAPMAN, 1923 (August 28), Amer. Mus. Novitates, No. 86, p. 17—Zamora, eastern Ecuador; ♀; American Mus. Nat. Hist.

There appears to be no definite distinction between Peruvian and Ecuadorian examples of this subspecies, although a greater series may show some concentration of characters sufficient to warrant a separation.

Two birds from the Río Chinchipe are essentially like Zamora specimens, which are not, in themselves, perfectly uniform. A third Río Chinchipe example is rather darker, and a young bird from Chaupé is still darker with the throat more grayish than usual. These localities are not far distant from the Zamora region and the differences noted are evidently purely individual. A similar tendency toward darker coloration occurs in birds from farther south in Perú where, also, it is not constant, as I have noted in an earlier paper [1930, Field Mus. Nat. Hist. Publ., Zool. Ser., XVII (7), p. 349].

Tschudi's record from the forest of the "western regions" of Perú is puzzling, since the forests visited by Tschudi were those of the interior valleys to the eastward. Tschudi's (and, later, Taczanowski's) description of a bright rufous uropygium throws a little doubt on the belief that the specimen in question properly belongs to *zamorae*, though it has been assigned there by Hellmayr. The only *Sclerurus* otherwise known at present from near the region visited by Tschudi is *caudacutus brunneus*. This subspecies, discussed on another page, may have the rump as rufescent as it is in *albigularis zamorae*, though it is never very rufous in either. Taczanowski referred Tschudi's bird to "*caudacutus*," together with skins from Yurimaguas and Chayavitas (these have since been retained in *c. brunneus*), while he kept "*olivascens*" from Monterico apart

<sup>1</sup>Specimens in Field Museum of Natural History, Chicago.

<sup>2</sup>Specimens in Carnegie Museum, Pittsburgh.

as a distinct species, though "*olivascens*" is a synonym of *brunneus*. With this confusion I am unwilling to extend the range of *zamorae* any farther southward than Huachipa, until specimens are available from some definite locality beyond this point.

#### SPECIMENS EXAMINED

*S. a. albicularis*.—TRINIDAD: Princetown, 3 ♂, 1 ♀; heights of Aripo, 1 ♂. VENEZUELA: Cristóbal Colón, 5 ♂, 2 ♀. COLOMBIA: Buena Vista, 3 ♂, 2 ♀.

*S. a. canigularis*.—COSTA RICA: Tenorio, 1 ♀.

*S. a. propinquus*.—COLOMBIA: Santa Marta, Valparaiso, 2 ♂, 2 (?); Las Nubes, 2 ♂, 2 (?).

*S. a. zamorae*.—ECUADOR: Zamora, 1 ♂, 3 ♀ (incl. type); Guayaba, Río Zamora, 1 ♀. PERÚ: Huarandosa, Río Chinchipe, 1 ♂, 2 ♀; Chaupe, 1 ♀; Huachipa, 3 ♂<sup>1</sup>, 2 ♀<sup>1</sup>.

#### *Sclerurus mexicanus peruvianus* Chubb

*Sclerurus mexicanus peruvianus* CHUBB, 1919, Bull. Brit. Orn. Club., XXXIX, p. 41—Yurimaguas, Perú; ♀; British Mus.

Twelve birds from Perú, eastern Ecuador, and Bolivia are in relatively close agreement with each other and apparently represent a single form for which the name *peruvianus* is available.

The general characteristics of this form consist of a rather dull coloration, with the rump hardly brighter than the back, and the upper tail-coverts rarely more than tinged with deep rufous. The under parts also are rather dull, with the rufous throat considerably lightened by the white bases of the feathers, while the breast is a little deeper rufous.

A single skin from Río de Oro, northwestern Ecuador, is probably typical of *obscurior*, being darker than any of the east-Ecuadorian or Peruvian skins but, like them, is without pronounced rufous on the uropygium. A female from El Chiral, southwestern Ecuador, is slightly paler though warmer than *peruvianus*, with the rump and upper tail-coverts definitely more strongly rufescent. A female from San Antonio, Colombia, is very similar. In all respects except the more rufous uropygium, these birds are closest to the Río de Oro specimen and doubtless should be referred to *obscurior*.

Birds from all other parts of Colombia are distinctly paler than *peruvianus*, though they have the uropygial area strongly rufous. The type of *andinus* is one of this sort and permits that name to be applied to this light-colored form. With the light tint of the back there is more of a rufous tone than in *peruvianus* and the throat appears to be clearer rufous, without so much white at the bases of the feathers.

<sup>1</sup>Specimens in Field Museum of Natural History.

Griscom [1932, Bull. Mus. Comp. Zool., Cambridge, LXVII (9), p. 346] has concluded that *anomalus* from Mt. Sapo, Panamá, is inseparable from *andinus*. With this conclusion I am quite in agreement although it leaves the arrangement of the Panamá forms in what is, at present, a confusing condition. The type and a male from Mt. Sapo, three males from Lion Hill, and a skin in poor condition from an indefinite locality in Darien, probably on the Río Tuyra (not far from Mt. Sapo), are all light-colored birds quite comparable to *andinus*. Griscom also has assigned examples from Permé, Obaldia, and Ranchon to this form.

On the other hand, two males and a female from Tacarcuna (4500–5200 feet), a female from Río Calovévora (1200 feet), and a pair from Chitrá (3500–4000 feet) are very dark in color, like the type of *pullus* from Boquete and a topotypical female. These localities are scattered and sometimes apparently separated by the places where *andinus* is found, but all of them are rather elevated, in distinction from the habitat of *andinus* which, at least in Panamá, reaches sea level. The only conclusion that appears to fit the situation is that *obscurior* is a mountain form, whereas *andinus*, living at relatively high elevations in Colombia, is restricted, in Panamá, to the lowlands. Very much more material of this rare species is needed to determine the full facts of its distribution.

#### SPECIMENS EXAMINED

*S. m. mexicanus*.—MEXICO: Jalapa, 2 ♂, 2 ♀; Potrero, 1 ♂<sup>1</sup>; Hondinas, 1 ♂<sup>1</sup>; near Vera Cruz, 1 ♀<sup>1</sup>; Orizaba, 1 (?)<sup>2</sup>.

*S. m. pullus*.—PANAMÁ: Boquete, 1 ♂<sup>2</sup> (type), 1 ♀<sup>2</sup>; Chitrá, 1 ♂, 1 ♀; Río Calovévora, 1 ♀; Tacarcuna, 2 ♂, 1 ♀. COSTA RICA: Cariblanca de Sarapiquí, 1 ♂<sup>2</sup>, 1 ♀<sup>2</sup>.

*S. m. andinus*.—COLOMBIA: Buena Vista (above Villavicencio), 1 ♀ (?) (type), 1 ♀, 1 (?)<sup>1</sup>, 1 (?)<sup>2</sup>; Puerto Valdiva, 1 ♀; La Frijolera, 1 ♀. PANAMÁ: Mount Sapo, 1 ♀<sup>2</sup> (type of *anomalus*), 1 ♂; Lion Hill, 1 ♂, 2 ♂<sup>2</sup>; Darien (=probably Río Tuyra), 1 (?)<sup>1</sup>.

*S. m. obscurior*.—COLOMBIA: San Antonio, 1 ♀. ECUADOR: Río de Oro, 1 ♂; El Chiral, 1 ♀.

*S. m. peruvianus*.—ECUADOR: Río Suno, above Avila, 2 ♂, 1 ♀; lower Río Suno, 1 ♂, 1 ♀; below San José, 1 ♀; mouth of Río Curaray, 1 ♂, 1 ♀; Zamora, 1 ♀. PERÚ: Huarandosa, 1 ♂; Santa Rosa, Río Ucayali, 1 ♀; Puerto Bermúdez, Río Pichis, 1 ♀<sup>3</sup>. BOLIVIA: mouth of Río San Antonio, 1 ♀.

*S. m. macconnelli*.—BRAZIL: Río Tapajoz, Limoã, 1 ♂; Tauarý, 1 ♀; Caxiricatuba, 2 ♀.

*S. m. bahiae*.—BRAZIL: "Bahia," 1 ♂.

<sup>1</sup>Specimens in U. S. National Museum, Washington.

<sup>2</sup>Specimens in Mus. Comp. Zool., Cambridge.

<sup>3</sup>Specimens in Field Museum of Natural History, Chicago.

***Sclerurus caudacutus brunneus* Selater**

*Sclerurus brunneus* SELATER, 1857 (June), P. Z. S. London, XXV, p. 17—Bogotá; British Mus.

*Sclerurus olivascens* CABANIS, 1873, Jour. für Orn., XXI, p. 67—Monterico, Ayacucho, Perú; ♀; type formerly in Warsaw Mus., now lost.

The present form is extremely similar to *S. c. umbretta* of Bahia in most particulars, but there is a certain amount of difference which, I believe, justifies the continued recognition of *brunneus*. In *umbretta* the throat is pure white to the bases of the feathers but with narrow blackish tips, and this gular area is narrowed posteriorly, not spreading on to the malar region which is very contrastingly warm cinnamonaceous brown. In *brunneus* the throat is duller, more soiled whitish with the bases of the lower feathers even more grayish or dull drab, restricting the whiter portion to the subterminal part of the webs; the tips are frequently more broadly dark than in *umbretta* but with a browner, less blackish hue, increasing the dullness of the general tone of this region, and in various examples the lower part of the malar region is involved in the whitish patch. The general plumage averages paler and more olive-tinted than in *umbretta*, though some examples are very similar. The malar region is correspondingly duller and the upper tail-coverts are usually a little brighter than the back. Young birds are less clearly distinguishable than adults, since the white or whitish gular area is not developed, but a young *umbretta* at hand has blackish tips on the throat, whereas a young *brunneus* has the tips brown like the breast.

Three Colombian males have longer tails than any Peruvian or Ecuadorian bird examined (63, 67, 65 mm., as against 60–61.5), but the same difference is not shown in the females and probably is not a constant factor. No constant differences in color are to be seen, though the darkest extremes are among the Ecuadorian specimens.

Cabanis's description of *olivascens* is brief, but agrees with *brunneus* except for the length of wing (94 mm.), which is larger than in any female at hand though smaller than in most *umbretta* (instead of larger, as stated). If the type of *olivascens* is a wrongly sexed male, the measurement is normal for *brunneus*.

Earlier Peruvian records include Yurimaguas, Chayavitas, Moyobamba, Iquitos, Monterico, and Marcapata.

The identity of *umbretta* is assured by five fresh specimens from Bahia, together with the type of *Sclerurus lawrencei* Ridgway and the male cotype of *Tinactor fuscus* Wied. The fresh specimens are so markedly different from a series of birds from the south bank of the

lower Amazon that it seems inadvisable to keep the latter in *umbretta* where birds from this region have hitherto been placed. The new form may be known as follows.

***Sclerurus caudacutus pallidus*, new subspecies**

TYPE from Villa Bella Imperatriz (Lago Andirá), Rio Amazonas (south bank), Brazil. No. 277,994, American Museum of Natural History. Adult male collected September 24, 1930, by the Olalla brothers.

DIAGNOSIS.—Somewhat similar to *S. c. umbretta* of Bahia, but decidedly paler in general coloration; breast and sides of head clay-colored instead of dark brown; upper tail-coverts but little more rufous than the back; belly moderately light brown.

RANGE.—Rio Tocantins (probably Pará district) west to the region between the Madeira and Tapajoz rivers, Brazil.

DESCRIPTION OF TYPE.—Top of head near Antique Brown, the feathers with darker median portions; hind neck and forehead a little paler; back darker; upper tail-coverts tinged with Auburn. Lores buffy, whitish at base; superciliary region, auriculars, and malar region Clay-Color × Buckthorn Brown, this color spreading across the chest, enclosing a white gular patch; throat-feathers with dusky, lunulate tips; lower breast and sides a little darker than the chest; belly Dresden Brown × light Brussels Brown; flanks and under tail-coverts darker. Wings externally dark Prout's Brown; lesser upper wing-coverts like the back; remainder of upper coverts like the remiges; under wing-coverts dull buffy gray (Tilleul-Buff). Tail blackish with the outer margins basally Dresden Brown × light Brussels Brown. Maxilla (in dried skin) black; mandible dull yellow, dusky toward tip; feet dull blackish. Wing, 93 mm.; tail, 65; exposed culmen, 19; culmen from base, 23; tarsus, 21.75.

REMARKS.—Females like the males but averaging slightly smaller.

The variations in this form appear to affect the dusky margins on the throat in noticeable degree. Some examples have these dark tips all but absent while others show heavy blackish lunules, in extreme cases involving the breast-feathers conspicuously and being visible even on the abdomen. Young birds are duller but of the same hues as the adults, though the throat is much less whitish. One example from Villa Braga, Rio Tapajoz, is somewhat more deeply colored than the rest, with a rufescent tone throughout, but the tones are clearer than in *umbretta*.

I have seen no examples from the immediate right bank of the Madeira nor from the vicinity of Pará, but there is little doubt that these regions belong in the range of *pallidus*.

A number of fresh skins from Bahia show that typical *umbretta* is a very dark form, decidedly more obscure than the lower Amazonian subspecies here described. The male cotype of *Tinactor fuscus* is a young bird and, though foxed, is of the same obscure tones, well shown by one of the fresh skins in the same stage of plumage. The type of *Sclerurus*

*lawrencei* is an adult, and though less foxed than the male cotype of *Tinactor fuscus*, is slightly discolored, resembling, to a certain extent only, the darkest examples of *pallidus*. Although the chest is faded it is far from the pale, ochraceous tone of fresh *pallidus* and the general coloration is dull. Since the type is a "Bahia" trade-skin, *lawrencei* undoubtedly is synonymous with *umbretta* and, in spite of its post-mortem discoloration, is more like fresh skins from Bahia than like lower Amazonian birds.

Two specimens of *caudacutus* from Faro are so different from French Guianan examples that they deserve separation also. They may be known as follows.

***Sclerurus caudacutus insignis*, new subspecies**

TYPE from Faro (Castanhal), Rio Jamundá, Brazil. No. 283,992, American Museum of Natural History. Adult male collected January 3, 1931, by the Ollalla brothers.

DIAGNOSIS.—Similar to *S. c. caudacutus* of French Guiana, but upper surface decidedly duller, less rufous, brown. Upper parts somewhat similar to *S. c. pallidus*, but throat with no pure white, only a restricted buffy white area centrally on upper portion and on chin, not sharply separated. Upper tail-coverts brighter rufous than in *pallidus*.

RANGE.—North bank of the lower Amazon, Brazil, in the vicinity of the Rio Jamundá.

DESCRIPTION OF TYPE.—Top of head Cinnamon-Brown with forehead brighter; back dull Prout's Brown, becoming more rufescent on rump; upper tail-coverts bright Auburn. Lores pale ochraceous; superciliary region a little paler than the crown; malar region deep Ochraceous-Tawny; auriculars somewhat darker; chin and a restricted area in middle of upper throat light ochraceous buff with narrow, hardly perceptible, dusky, terminal margins and buffy whitish bases; sides of throat, lower throat, and chest warm Sudan Brown with pale buffy shafts, passing into Brussels Brown on lower breast and warm Prout's Brown on the belly; sides, flanks, and under tail-coverts darker. Wings with exposed outer margins Prout's Brown tinged with Raw Umber; upper wing-coverts similar; under wing-coverts pale Wood Brown. Tail blackish, with outer margins of rectrices basally light fuscous. Bill (in dried skin) black with basal half of mandible dull yellowish. Feet blackish brown. Wing, 96 mm.; tail, 70; exposed culmen, 21; culmen from base, 25.5; tarsus, 21.5.

REMARKS.—The single female at hand is duller (less rufous) on the under parts than the male, thus approaching the tints of *pallidus*, though the throat is even less whitish than in the type. The back and head are a little paler and less warmly colored than in the male but the upper tail-coverts are decidedly brighter rufous, being light Chestnut.

The present form is thus quite intermediate between *pallidus* and *caudacutus* but is not referable to either. It is possible that British Guianan examples may be found to approach this form closer than true *caudacutus*. Dr. Hellmayr (1907, Novit. Zool., XIV, p. 56) has noted that

British Guianan specimens have the chin and upper throat pale tawny with scarcely any traces of the brown edges observed in a Cayenne skin. Three specimens from French Guiana before me have the tips of the gular feathers no more brownish than in the two *insignis*, but all three Guianan birds agree in the much stronger rufescence of both upper and under parts except for the upper tail-coverts.

## SPECIMENS EXAMINED

*S. c. caudacutus*.—FRENCH GUIANA: Tamanoir, 1 ♂, 1 ♀; "Cayenne," 1 (?).

*S. c. insignis*.—BRAZIL: Faro (Castanhal), 1 ♂ (type), 1 ♀.

*S. c. pallidus*.—BRAZIL: Villa Bella, Imperatriz (Lago Andirá), 3 ♂ (incl. type), 2 ♀; (Serra de Parintins), 4 ♂, 1 ♀; Rio Tapajoz, Igarapé Brabo, 1 ♀; Limoal, 2 ♂, 1 ♀; Villa Braga, 1 ♀; Rio Tocantins, Baião, 1 ♀; Pedral, 5 ♂, 2 ♀.

*S. c. umbretta*.—BRAZIL: "Brasilia" (=Bahia), 1 ♂ (cotype of *Tinactor fuscus*); "Bahia," 1 ♀ (type of *S. lawrencei*); Cajazeiras, 1 ♂, 4 ♀.

*S. c. brunneus*.—COLOMBIA: Florencia, 1 ♂; La Morelia, 2 ♂, 2 ♀. ECUADOR: Río Suno, above Avila, 2 ♂, 2 ♀; lower Río Suno, 1 ♂, 3 ♀; below San José, 1 ♂, 1 ♀; mouth of Río Curaray, 1 ♂, 2 ♀. PERÚ: Pomará, 1 ♂; Orosa, 1 ♀; Santa Rosa, upper Ucayali, 2 ♀; mouth of Río Urubamba, 1 ♀.







## ORIGIN OF THE SEGMENTAL COLORATION OF AMETHYST AND SMOKY QUARTZ

BY CLIFFORD FRONDEL

### OUTLINE

	PAGE
DESCRIPTION OF THE SEGMENTAL COLORATION.....	1
ORIGIN OF THE SEGMENTAL COLORATION.....	5
SIGNIFICANCE OF THE SEGMENTAL COLORATION OF SMOKY QUARTZ AND OF VARICOLORED OVERGROWTHS.....	10
HISTORICAL NOTES ON THE PIGMENT OF AMETHYST.....	13
BIBLIOGRAPHY.....	14

### DESCRIPTION OF THE SEGMENTAL COLORATION

The pseudo-racemic twinning and the pigmentation of the amethyst variety of quartz have been the occasion of numerous studies,<sup>1</sup> but many questions concerning these characteristics of the variety have not as yet been answered, among which is that of the origin of the sectoral distribution of color commonly seen in cut basal sections. This feature, early remarked on and figured by Brewster (1823), and by many of the subsequent workers, is seen as three colored radial triangular sectors based upon alternate faces of the hexagonal prism which bounds such sections and alternating with three uncolored triangular sectors. When the six sectors are symmetrical and of equal size, their apices meet at the center of the section, but it is usually found that the three uncolored triangular sectors are subordinate in size and occupy the marginal portion of the section but with their altitudes, when extended, still meeting at the center. The colored sectors in such instances have a seven-sided outline, the interior apical angle being 120°. In some instances only three (colored) sectors are present, each of 120° at the apice. Occasionally it is found that all six of the sectors are amethystine, but generally of a lighter shade in the smaller sectors, or that the smaller sectors have a citrine or smoky color, the sectorally distributed amethyst color appear-

<sup>1</sup>Among which can be mentioned those of Brewster (1823), Marx (1831), Rose (1844), Haidinger (1845-1854), Dove (1853), Descloizeaux (1855), von Rath (1874), Groth (1877), Bäckén (1883), Judd (1888, 1893), Lacroix (1901), Tutton (1911, 1924), Raman and Banerji (1925) and Mügge (1932) on the twin structure and optical behavior, and of Rose (1800), Heintz (1843), Rammeisberg (1875), Weinschenk (1896, 1900), Kraatz-Koschlau and Wöhler (1899), Nabl (1899, 1900), Hermann (1908), Doelter (1908-1915), Watson and Beard (1917), Wild, and Wild and Liesegang (1922-1932), Holden (1923, 1925) and Klemm (1925, 1927), among others, on the pigmentation.

ing to be superposed on a uniform citrine or smoky coloration. A further well known peculiarity in connection with the sectoral coloration is in that the pseudo-racemic twinning characteristic of the variety is found chiefly in the colored sectors. A photograph of a sectorally colored amethyst is given in Fig. 1 and of a sectorally colored smoky quartz crystal in Fig. 2. Photographs and drawings of the color distribution and of the twin structure are also given by Tutton (1911, 1924), Judd (1893) and Brauns (1903).

When entire crystals are examined it is seen that the sectoral coloration of basal sections is present as a segmental coloration in the whole, the pigment being disposed in regions or segments of the crystal subjacent to certain of the growth faces and extending inward with diminishing size to the center or original nucleus of the crystal. When the crystals are examined more closely it is seen that the pigment present in the colored segments is generally distributed in thin and closely spaced layers or planes parallel to the growth faces bounding each particular segment. Crystals whose colored segments do not exhibit color planes, or in which the color planes are too thin and too closely spaced to be discernible, are uncommon. In very light colored crystals the color planes may be widely spaced, several millimeters or more apart, and may be seen then only by orienting the crystal so as to view the trace of the plane. This distribution of the color in planes and interior segments related to the growth surfaces is consistent with the idea that the pigmentsing substance was included by the crystal during its growth. The color of amethyst is occasionally distributed quite irregularly within the crystal. Amethysts otherwise evenly colored sometimes contain small irregularly bounded regions of a very intense color, and colorless crystals may be similarly pigmented. Schoolcraft (1824) says of an occurrence of smoky quartz at Keewiweenon Point, Michigan Territory, that "The colour is not equally intense, but often appears in clouds, and is mingled with the violet hue of the amethyst" and of amethyst from the same locality as "Its colour passes from violet to purple, and is seldom uniformly diffused. It is intimately connected with the preceding variety (smoky quartz), and the colours so mingled, in some pieces, as to make it difficult to determine to which sub-species they ought to be placed." Color planes parallel to the growth faces are usually discernible, however, within such irregularly colored regions. The apical parts of the rhombohedral faces of amethyst are quite generally more deeply colored than the remainder of these faces. The distribution of color in amethyst has also been described by Wild and Liesegang (1923).

Study of a commercial stock of uncut amethysts<sup>1</sup> and of a suite of amethyst and smoky quartz crystals in the collection of The American Museum of Natural History, including a number of sectioned crystals, has brought out that, of the three forms— $(10\bar{1}1)$ ,  $(01\bar{1}1)$  and  $(10\bar{1}0)$ —commonly present on quartz crystals, the three faces of the terminating positive rhombohedron  $(10\bar{1}1)$  invariably contain pigmented segments beneath them and that it is these segments that when exposed in a basal section yield the sectoral coloration seen therein. Of the two remaining forms the terminating negative rhombohedron  $(01\bar{1}1)$  is found to frequently occur with colored segments beneath its faces while the prism  $(10\bar{1}0)$  less frequently occurs so. Crystals colored by  $(01\bar{1}1)$  alone were not observed, although crystals colored by  $(10\bar{1}1)$  are common, and when the former contains colored segments it is found to do so only in conjunction with  $(10\bar{1}1)$ . When  $(10\bar{1}0)$  occurs colored it is found so usually in conjunction with both  $(10\bar{1}1)$  and  $(01\bar{1}1)$ , although the combination of  $(10\bar{1}0)$  and  $(10\bar{1}1)$ , with  $(01\bar{1}1)$  uncolored, was met with in a few instances. Crystals in which all three of the forms are present and are uniformly colored are rare. When two or all three of the forms are colored it is frequently noted that the color is most intense in the segments belonging to  $(10\bar{1}1)$ . It is difficult to observe such a difference in intensity of coloration, however, particularly when the faces of one form, usually those of  $(10\bar{1}1)$ , are large in comparison with the others, except by sectioning or fracturing the crystal. Uniformly colored amethyst crystals are commonly found to have a pyramidal habit, the prism  $(10\bar{1}0)$  being absent, and this habit seems to be particularly common with more deeply colored crystals. Several instances were observed of crystals in which both  $(10\bar{1}1)$  and  $(01\bar{1}1)$  had included pigment during the early stages of their growth but in which  $(01\bar{1}1)$  had, during a later stage of growth, abruptly stopped including pigment on its faces while  $(10\bar{1}1)$  continued to do so.

The peculiarities of coloration and of the size and distribution of the sectors of basal sections are all explainable by considering the habit of the sectioned crystal, the identity of the colored and uncolored segments, and the point, with reference to the original nucleus of the crystal, at which the section intersects the colored segments. In basal sections cut through the rhombohedral faces of a crystal bounded by the three common forms and in which  $(10\bar{1}1)$  is selectively colored, the colored and uncolored sectors are the horizontal projections of the terminating rhom-

<sup>1</sup>Through the courtesy of Mr. M. B. Hanauer of the American Gem and Pearl Co., New York City, to whom the writer is also indebted for a gift of specimens.

bohedral faces, but in sections cut from near the base of the same crystal the sectoral portion is smaller, although the sizes of the sectors are still in the same ratio as the sizes of the terminating faces, and it is located in the interior of the section. The latter sections may then be bordered by a uniformly colored or uniformly colorless zone according to whether the segments below the prism ( $10\bar{1}0$ ) faces are pigmented or not. Several such instances were observed with smoky quartz. The general predominance in size of the colored set of sectors over the colorless set, as seen in section, reflects the general tendency of quartz to develop a habit in which ( $10\bar{1}1$ ) predominates over ( $01\bar{1}1$ ). Distorted crystals may yield sections with an unusual arrangement of sectors; some of the sections figured by Descloizeaux are remarkable in this respect. A section figured by Brewster which contains four colored and twinned sectors is presumably due to an accidental intergrowth of another crystal or to a twinned insert which happened to bring in an additional sector.

A segmental coloration is also found to occur occasionally in smoky quartz crystals. One of a group of sectioned smoky quartz crystals from Brazil, originally contained in the collection of the late George F. Kunz, exhibits an interior sectoral light brown coloration with a uniform border of a smoky color. The pigment is present in sharply marked color bands in each of the two portions, occurring in vertical planes parallel to ( $10\bar{1}0$ ) in the outer border and in planes parallel to a rhombohedron in the inner sectoral portion. A similar distribution of a smoky color was observed in a sectioned smoky quartz crystal from the Little Pipestone district, Jefferson Co., Montana. A pronounced segmental coloration beneath a set of rhombohedral faces, with color planes, is shown by a smoky crystal from New Zealand (Fig. 2). This crystal is enclosed within a larger crystal of colorless quartz which has been artificially rounded off and polished so that the base of the specimen, which is cut  $\perp$  to  $c$ , and through which the segmental coloration is observed, does not possess a hexagonal outline. A segmental coloration beneath the faces of a terminating rhombohedron was also observed in light colored smoky quartz crystals from the Mourne Mts., Ireland, this being the only further instance of a segmental coloration of smoky quartz seen by the writer. The pigmented segments in all of these instances are beneath one of the two terminating rhombohedrons, the prism being also pigmented in two of the instances, but it was not possible in any of them to identify the particular rhombohedron responsible for the coloration. It is probable, however, that the pigmented faces are those of the positive rhombohedron, as this form is known to selectively include the pigment of amethyst and also other

foreign substances, to be mentioned shortly. Brewster has described a section exhibiting a yellowish sectoral coloration, an amethyst tint being lacking, in which the colored sectors are twinned in the fashion of amethyst. Twinning of the pseudo-racemic type, on the Brazil law, was not observed in any of the sectorally or uniformly colored sections of smoky quartz examined by the writer, but relatively simple twins on  $(10\bar{1}0)$  were noted.

In a specimen of pale smoky quartz from Brazil it was noted that the color planes parallel to the terminating rhombohedrons were more deeply pigmented in the regions of these planes immediately adjacent to the edges between the rhombohedrons. In another specimen of Brazilian smoky quartz the color planes were observed to contain macroscopic particles of a white flocculent material (chalcedony ?) which were more abundant in the outermost growth or color planes of the crystal.

A segmental coloration is seemingly much less abundant with smoky quartz than with amethyst, with which variety it is very frequently met. Color planes parallel to the growth surfaces are of general occurrence in smoky quartz, however, with the exception of crystals from the Swiss localities. The color of these is usually evenly distributed.

#### ORIGIN OF THE SEGMENTAL COLORATION

Segmental colorations can be produced experimentally by growing crystals of alum and other substances from solutions containing a small amount of a suitable dye. The dye in these instances is adsorbed selectively by one of the forms bounding the crystal during its growth so that colored segments are formed subjacent to the faces of the adsorbing form, meeting at the center (nucleus) of the crystal, while the segments subjacent to the faces of the non-adsorbing form or forms remain uncolored. Such instances have been described by a number of writers and the phenomenon has been treated at length by France and co-workers (1930). A photograph of a segmentally colored alum crystal is given in Fig. 3. This phenomenon is the same as that of the modification of crystal habit by the selective adsorption of a foreign substance contained in the crystallizing solution and differs only in that the adsorbed substance is visible by reason of its color.

The well known hour-glass crystals of augite, so-called because of the two-fold divergent sectoral distribution of color as seen in section, have also been interpreted as resulting from the adsorption of  $\text{TiO}_2$  or a colored titania-rich molecule by one of the growth forms of the crystal (Scott, 1914). A double hour-glass sectoral coloration has also been

described in a large torbernite crystal by Hallimond (1916). This crystal is bounded by (001), (101), (103) and (112) and is described as having the latter form selectively stained by the pigment (i.e., adsorbed) during the growth of the crystal, so that a basal cleavage section reveals colored or turbid sectors based upon the faces of this form and extending to the center while the other sectors are uncolored. Color bands are also shown by the crystal. Fluorite crystals possessing a segmental coloration have been described by Steinmetz (1925) who figures sections bounded by faces of (110) and (100) in which the pigment has been included during growth in the sectors based upon the latter form while the sectors based upon (110) are not pigmented. Drugman (1932) has described and figured fluorite dodecahedrons modified by small faces of the octahedron which possess six small localized patches of a violet color disposed internally in the direction of the four-fold axes of symmetry, each patch of color being located a little below the summit of the six corresponding four-fold corners of the crystal. These patches may represent small selectively pigmented faces of (100) originally present on the crystal and later overgrown. Kennigott (1854) has mentioned a green trisoctahedron of fluorite modified by narrow dodecahedral faces which are of a violet color and also another crystal of fluorite in which the three axial sections are colorless and the rest of the crystal violet blue. A specimen of fluorite, from Cornwall, in the collection of the American Museum, exhibits colorless cubes modified by faces of a tetrahexahedron which contain a zone or segment about 1 mm. thick of a deep purple color beneath them. Another specimen, also from Cornwall, exhibits fluorite crystals of a similar habit but in which the cube portion is of a light sea green color while very thin segments beneath the tetrahexahedral faces are of a light violet color. In both of these instances the crystals appear to have grown as simple cubes during the early stages of growth while the tetrahexahedron developed at a late stage of growth, the two forms then growing simultaneously with the tetrahexahedral faces selectively including a purple or violet pigment. A large deep amethyst colored fluorite crystal from Illinois contains an interior phantom of a cubo-octahedral habit which is visible, when the crystal is held against a source of light, by reason of the absence of pigment in the segments belonging to the octahedral faces. These segmentally colored fluorite crystals also appear to be the result of the selective adsorption of pigment by the forms of the growing crystal. Color planes are found in many colored fluorite crystals, whether segmentally colored or not. Further instances of the segmental coloration of crystals have been

described by Pelikan (1896) for augite, barite and other natural species and for artificially colored crystals of strontium nitrate.

In the case of amethyst and smoky quartz it is likewise believed that the segmental coloration described is due to the selective adsorption of the pigmenting substance<sup>1</sup> by the growth faces of the crystal. Of the three common forms the positive rhombohedron ( $10\bar{1}1$ ) is the most strongly adsorbing with the negative rhombohedron ( $01\bar{1}1$ ) less strongly adsorbing but more so than the prism ( $10\bar{1}0$ ), judging from the relative frequency of occurrence. The invariable continuity of the color planes parallel to the prism faces around the crystal reflects the identical structure and hence equal adsorbing power of the six faces of this form while the unequal adsorbing power of the two rhombohedral forms is in accordance with their different structures, as revealed by the difference in etch figures upon them and their different rates of growth and solution. The rate of solution is greater upon the negative rhombohedron than upon the positive rhombohedron while the prism is much more resistant to solution than either of these two forms. The rate of solution is greatest in the direction of the vertical axis. The prism seems to be in general the slowest growing of the three common forms, as is testified by the prismatic habit characteristic of the species.

This interpretation of the segmental coloration is, for amethyst, supported by the occurrence of quartz crystals whose surfaces are selectively filmed by iron oxide, this substance apparently being adsorbed from a sol which bathed the crystals after the completion of their growth. A suite of specimens from West Paterson, New Jersey, exhibits drusy surfaces of small colorless quartz crystals filmed over upon ( $10\bar{1}1$ ) or upon ( $10\bar{1}1$ ) and ( $10\bar{1}0$ ), the form ( $01\bar{1}1$ ) in all of the instances remaining unfilmed (Fron del, 1934a). The film varies between brownish red, red and brick red in color, and while thin is quite dense. It may be rubbed off, revealing the undersurface to be smooth and brilliant. Adsorption of the iron oxide during the growth of the crystal in these instances would presumably have resulted in the formation of a segmentally colored amethyst. Calcite crystals associated with the quartz crystals of these specimens are also selectively filmed over by iron oxide (Fron del, 1934b). A photograph of an amethyst crystal from Thunder Bay, Michigan, in the collection of the Illinois State Museum, whose surface is selectively filmed over by iron oxide, has been published by Crook

<sup>1</sup>Which for amethyst is known to be a compound of ferric iron (Holden, 1924), and is very probably colloidal hydrous iron oxide approaching goethite in composition.



(1920). This crystal<sup>1</sup> measures about  $4\frac{1}{2}$  by 4 inches, with a base of white quartz, and has three alternating faces filmed over by iron oxide, particularly towards the apical parts of these faces, while the other three faces are without indication of iron oxide. The three filmed faces are slightly larger than the three faces of the unfilmed form, which suggests that the former are those of the positive rhombohedron ( $10\bar{1}1$ ). A case in which a varnish-like coating of powdery rutile is selectively disposed upon the apical parts of three alternating rhombohedral faces of a Brazilian quartz crystal, the other three faces being uniformly covered, has been described by Brewster (1853). The identity of the forms in this instance is not known. Instances have also been described (Fron del, 1934a) of quartz crystals of which the faces of ( $10\bar{1}1$ ) have selectively adsorbed and included during the last stages of growth quantities of colloidal clay material, the faces of ( $01\bar{1}1$ ) being non-adsorbing. The ( $10\bar{1}1$ ) faces in these instances possess an enameled or pearly sub-metallic luster similar to that of the cotterite variety of quartz, which variety has similarly resulted from the (non-selective) inclusion of colloidal clay substance.

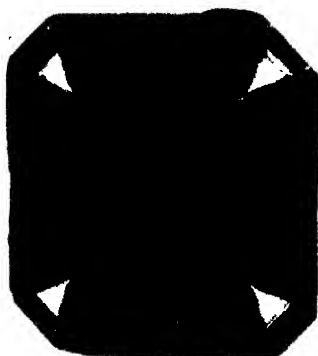
The observation frequently made, first apparently by Beck (1842), to the effect that the quartz crystals occurring in deposits of iron ore are characterized by the development of a bipyramidal habit, the prism being absent, is also of interest in this connection. It is found that the form of artificially grown crystals which adsorbs dyes or other substances tends to become the dominant habit of the crystal, since the action of the adsorption is to decrease the growth velocity of the form by cutting down the normal accretion on the surface, and, since the two terminating rhombohedrons of quartz are generally more strongly adsorbing for iron oxide than the prism, as is known from the adsorbing behavior of amethyst, a bipyramidal habit can be expected to develop on quartz crystals growing in such an environment. The ( $10\bar{1}1$ ) form of quartz is more strongly adsorbing for Ca ion than ( $01\bar{1}1$ ) and both ( $10\bar{1}1$ ) and ( $01\bar{1}1$ ) are more strongly adsorbing than ( $10\bar{1}0$ ), as is shown by the pseudo-cubic or bipyramidal habit developed by quartz occurring in gypsum deposits (Tarr, 1929; Tarr and Lonsdale, 1929).

A further point of interest in connection with amethyst lies in the fact that the segments of the crystal beneath the faces of ( $10\bar{1}1$ ), which is the most strongly adsorbing form, are generally those which contain the pseudo-racemic twinning characteristic of this variety of quartz, the

<sup>1</sup>A description of this specimen was kindly furnished by Mr. A. S. Coggeshall, Chief, State Museum Division, Department of Registration and Education, Illinois.



Fig. 1



*W. G. France photo.*

Fig. 3

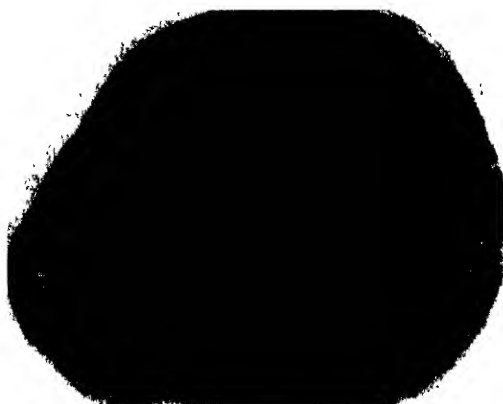


Fig. 2

Fig. 1. A cut amethyst with a sectoral coloration. The table of the stone is cut  $\perp$  c. Ceylon. (Morgan Gem Collection.)

Fig. 2. A sectorally colored smoky quartz crystal. The smoky crystal is enclosed in a larger crystal of colorless quartz the surface of which has been artificially rounded off. The section is  $\perp$  c. New Zealand.

Fig. 3. A double hour-glass segmental coloration produced by the adsorption of diamine sky blue at the (100) faces of an ammonium alum crystal. The segments beneath (111) are uncolored and their borders appear dark in the photograph only as the result of the reflection of the light from these surfaces.

other segments being untwinned or twinned once with the composition plane approximately bisecting the segment. The coincidence of the twinning and the selective coloration, beneath (10 $\bar{1}$ 1), of sections was first remarked on and figured by Brewster and has been noted by many of the later workers. Bunn (1933) has recently pointed out that a sort of mimetic twin structure is shown by the segments beneath the adsorbing faces of several artificial crystal species, as a consequence of the adsorption, and that anomalous birefringence may also be produced in crystals containing adsorbed impurities. Bunn states that sodium chlorate crystals selectively adsorb thiosulphate on the faces of the tetrahedron and that crystals composed of the cube and the tetrahedron exhibit anomalous birefringence in the segments subjacent to the faces of the latter form. From this it appears that the twinning of amethyst may be induced by the adsorption of the foreign substance causing the color, a view that has also been expressed by Mügge (1907) and others. Tutton (1911, 1924) and Judd (1888, 1893) ascribed a secondary origin to the twinning of amethyst and also to its color. The pleochroism of amethyst may be due to oriented adsorption.

#### SIGNIFICANCE OF THE SEGMENTAL COLORATION OF SMOKY QUARTZ AND OF VARICOLORED OVERGROWTHS

Holden (1925), in a notable paper, has advanced the theory that smoky quartz owes its color to the presence of colloidal particles of free silicon liberated by the action of radium radiation on an originally colorless crystal. The distribution of the pigment of smoky quartz in color planes and occasionally also in selectively pigmented segments, both of which are related to the growth surfaces, is, however, direct evidence of the inclusion of the pigment during the growth of the crystal. The fact that the pigmented regions of smoky quartz alternate with regions of colorless quartz is itself not compatible with Holden's theory, since a secondary pigment produced by the disintegration of the silica should be in uniform distribution throughout the crystal. The association by overgrowth of differently colored crystals of essentially the same period of formation also militates against the view of a secondarily produced color.

A specimen from Delaware County, Pennsylvania, in the collection of the American Museum, exhibits a large, doubly terminated bipyramidal crystal of smoky quartz with an interior phantom of amethyst quartz; other specimens from this locality show large crystals with an amethyst color in the segments subjacent to the faces of the two termi-

nating rhombohedrons and a smoky color in the segments subjacent to the faces of the prism.<sup>1</sup> A crystal from Pikes Peak, Colorado, is smoky towards the base and amethystine towards the apice, and somewhat similar specimens from Mt. Antero, Colo., show crystals towards the base of which smoky color planes surround a very faintly amethystine interior. The specimen shown in Fig. 2, from New Zealand, consists of a smoky phantom in a colorless quartz crystal, and similar occurrences were observed from Hot Springs, Arkansas. and Graubunden, Switzerland. A group of specimens from an unknown locality in Brazil exhibit amethyst phantoms in colorless quartz. Related to these occurrences are sceptre crystals of quartz which exhibit color differences. On finely developed crystals of this nature from Carlow, Ireland, the enlarged end is of a smoky color while the thinner supporting prism is of almost colorless quartz. On similar specimens from Monroe, Connecticut, and Alexander County, North Carolina, the enlarged portion is colorless, or almost so, and the thinner prism part of a pale smoky color. A sceptre quartz specimen from Sonora, Mexico, shows terminal amethystine enlargements of colorless prisms. Further evidence is afforded by specimens showing two generations of quartz as oriented overgrowths. Suites of specimens from the Little Pipestone district, Jefferson Co., Montana, and from the Pikes Peak region, Colo., exhibit overgrowths of amethyst crystals on smoky quartz crystals, and identical occurrences were observed on specimens from Switzerland (exact locality unknown); Amherst County, Virginia; and from Lincoln County, N. C. A specimen from Noyes Mtn., Greenwood, Maine, exhibits fine smoky crystals containing color bands overgrowing colorless to milky quartz. Amethyst crystals overgrowing colorless quartz crystals were observed on specimens from Schemnitz, Bohemia; Guanajuato, Mexico; and St. Gothard, Switzerland. Specimens from Bear Creek, Colo., and Crystal Peak, Colo., consist of smoky crystals with an overgrowing layer of white opaque quartz. Wada (1904) mentions quartz crystals from a locality in Japan which present a zonal structure of colorless, smoky and sometimes amethyst layers. These colors are apparently all present in the same crystal although this is not directly stated. A zonal distribution of color (that is, in color planes) in crystals from another locality is described as consisting of a core of alternate layers of colorless and smoky quartz which is covered with an amethystine layer.

These features of association and color distribution are best ex-

<sup>1</sup>James Bruce, in 1813 (*Amer. Miner. Jour.*, I, No. 4, p. 242) says that a Mr. Cloud of the United States Mint suggested that the color of the amethyst from this locality was due to titanium (oxide), a view also taken by Wherry (1904, *Mineral Collector*, XI, p. 88).

plained on the basis that the crystals included the pigmenting substance during their growth from the solution, the solution varying in its content of pigmenting substance, and, also, in the kind or kinds of pigmenting substance present, since if the color were a secondary one brought out by radiation, both generations of the crystals and all parts of a single crystal would be equally affected. Holden has argued on similar grounds that an occurrence described by him of gray quartz and rose quartz in juxtaposition casts doubt on the theory that rose quartz has a secondary color produced by the action of radium radiation on white quartz. Since silicon is unlikely to exist in the free state as a (colloidal) constituent of natural solutions, the question of the nature of the pigment in natural smoky quartz must be considered an open one. The smoky color produced in radiated colorless quartz may be colloidal free silicon, as thought by Holden and others, but the similarity in color between the natural and synthetic varieties must be considered as only accidental. Glass may be colored shades of yellow and brown both by the addition of carbon to the melt and by radiation.

Holden has stated in support of his thesis that smoky quartz is characteristically associated with radioactive minerals, but numerous occurrences are known without such an association. Whitlock (1905) has described an occurrence of smoky quartz at Rondout, Ulster Co., New York, where it is found as smoky crystals with strongly marked color planes and as smoky phantoms in colorless crystals in clay pockets in the Manlius limestone.<sup>1</sup> Small amounts of an anthracitic hydrocarbon occur in the limestone. The well known quartz crystals from localities in Herkimer County, N. Y., which occur in cavities in a carbonaceous Ordovician limestone, are generally perfectly transparent and colorless, but a suite of specimens in the American Museum possess a pale but quite definite smoky color. These crystals contain visible specks of a brilliant black anthracite-like hydrocarbon. Dana (1893) mentions smoky quartz as occurring at Little Falls, Herkimer Co., N. Y., where it is found with calcite and barite in the limestone. Beck (1842) says that the anthracitic hydrocarbon commonly associated with the quartz from this region of New York State is frequently diffused throughout the entire body of the crystal. Smoky quartz is also found occasionally associated with zeolites in the New Jersey diabase region, as at Great Notch, Paterson and West Paterson (Manchester, 1931), although the quartz from these localities is generally colorless or amethy-

<sup>1</sup>The writer is indebted to Dr. David H. Newland of the New York State Museum for an opportunity to examine some of these specimens.

stine, and it has been noted as occurring in crystalline limestone at Newton, New Jersey, associated with spinel, graphite, chondrodite, etc. Whitlock (1903) also notes occurrences of smoky quartz in crystalline metamorphic limestone at Kingsbridge, N. Y., and from near Port Henry, N. Y., associated with pyroxene, graphite and other species. Robinson (1825) mentions smoky quartz as occurring in cavities in trap rock at East Haven, Conn., associated with amethyst, chalcedony and analcite, and also dark smoke brown quartz as occurring in limestone near Quebec, the crystals from this locality being stated to contain in rare instances a drop of a pale bituminous liquid. Since there is no radiation available in these occurrences this would dispose of a theory to the effect that the distribution of color in planes parallel to the growth faces is due to the inclusion during growth of a colorless impurity which localized the action of the radiation.

The observation of Nutting (1931) that quartz surfaces adsorb unsaturated hydrocarbons with such intensity that they are "cracked," with the formation of free carbon, is of significance in this connection.

#### HISTORICAL NOTES ON THE PIGMENT OF AMETHYST

It is of interest to note that the color of amethyst was ascribed to iron (oxide) by John Woodward in 1729, who speaks of an occurrence of quartz as ". . . some of the crystals Red, others Amethystine; concreted on a crust of Iron-ore, growing on the side of a perpendicular fissure in St. Vincent's Rock, Bristol. These different colors are owing to the different Proportions of ferreous corpuscles uniting with the Crystalline in the Concretion." Woodward also notes an occurrence of cubic spar (fluorite ?) with a purple cast of color from a lead mine at Nenthead, Cumberland, and states that the color is owing to an infinitely small admixture of iron. Poggendorf (1841) is said to be the first to ascribe the color of amethyst to a compound of iron, but the idea had been already expressed not only by Woodward but also by Marx (1831), who believed that hydrated iron oxide was the pigmenting substance, and by Haüy (1817), who believed that the color of amethyst and all other gems, with the exception of emerald and spinel, was due to iron oxide. Brewster (1853) speaks of amethyst as having grown from "amethystine solutions."

J. F. Henckel, in 1725, thought that the color of amethyst might be due to (colloidal) gold: "In particular the violet cast of the amethyst, and the red blush of the jasper, whereby it comes to resemble coral, would seem to suggest an enquiry, whether their tint be not owing to the

share of metal they contain. I know not, whether the amethyst does not hold gold; as there is no experiment extant for giving such a violet colour to a stone, or stony glass-flux, except by the means of gold, with the addition of tin, especially as I have a method of imparting this colour to spring water, without making it less sweet and potable, . . . " Henckel is referring to the "Purple of Cassius." Elsewhere Henckel states that the red and brown colors of certain cryptocrystalline varieties of quartz are due to included iron oxide. Ebelmen, in 1847, produced amethystine, topaz-yellow and rose-colored hyalite and hydrophane by means of colloidal gold. His method was to precipitate silica gel from silicic ether mixed with an alcoholic solution of gold chloride and to expose the product to diffuse light or to the direct light of the sun. Diffuse light yielded topaz-yellow colors, and, with time, aventurine gels containing flaky gold; this seems to be a pigment color while the violet blue tints, which were obtained by the action of direct sunlight, are certainly structural colors. The aventurine gels were greenish by transmitted light. Holden (1924) obtained rose-colored silica gels by using manganese salts. Doelter (1909) produced synthetic rose quartz colored by colloidal gold by passing a current through a gilded quartz section held at a high temperature.

## BIBLIOGRAPHY

- BECK, L. C. 1842. 'Natural History of New York State,' Part 3: Mineralogy of New York, p. 386.
- BRAUNS, R. 1903. 'Das Mineralreich' (transl. by L. J. Spencer, London, 1912). p. 265, fig. 205; pp. 269-270, Pl. LVI, fig. 8.
- BREWSTER, D. 1823. Trans. Royal Soc. Edinburgh, IX, pp. 139-152.  
1853. Trans. Royal Soc. Edinburgh, XX, p. 55, Pl. xv, fig. 5.
- BUNN, C. W. 1933. Proc. Royal Soc. London, CXXI, A, pp. 567-593.
- CROOK, A. R. 1920. 'Guide to the Mineral Collections in the Illinois State Museum.' Springfield, p. 8, Pl. xvii.
- DANA, E. S. 1893. 'Catalogue of American Localities of Minerals.' New York, p. 10.
- DOELTER, C. 1909. Kolloid-Zeits., IV, p. 188.
- DRUGMAN, J. 1932. Mineralog. Mag., XXIII, pp. 139-140.
- EBELMEN, J. J. 1847. Compt. rend., XXV, pp. 854-856.
- FOOTE, F. G., BLAKE, F. C., AND FRANCE, W. G. 1930. Jour. Phys. Chem., XXXIV, pp. 2236-2240.
- FRANCE, W. G. 1930. Colloid Sympos. Annual, VII, pp. 59-87.
- FRONDEL, C. 1934a. Amer. Min., XIX, pp. 318-320.  
1934b. Amer. Mus. Nat. Hist. Novitates, No. 695, pp. 3-5.
- HALLIMOND, A. F. 1916. Mineralog. Mag., XVII, p. 327.
- HAÛY, R. J. 1817. 'Traité des caractères Physiques des Pierres Précieuses, pour servir à leur Determinacion lorsqu'elles ont été taillées.' Paris.

- HENCKEL, J. F. 1725. *Pyritologia*. Leipzig (London, 1757), p. 44.
- HOLDEN, E. F. 1924. *Amer. Min.*, IX, p. 108.  
1925. *Amer. Min.*, X, pp. 203-252.
- JUDD, J. W. 1888. *Mineralog. Mag.*, VIII, pp. 1-9.  
1893. *Mineralog. Mag.*, X, pp. 123-135.
- KENNGOTT, G. A. 1854. *Sitzber. Akad. der Wiss. Wien*, XIII, p. 481.
- LASH, M. E., AND FRANCE, W. G. 1930. *Jour. Phys. Chem.*, XXXIV, pp. 724-736.
- MANCHESTER, J. G. 1931. 'The Minerals of New York City and its Environs.'  
New York. Pp. 82, 86.
- MARX, C. M. 1831. *Jahrb. der Chemie und Physik*, n.s., I, p. 13.
- MÜGGE, O. 1907. *Neues Jahrb.*, p. 181.
- NUTTING, P. G. 1931. *Jour. Wash. Acad. Sci.*, XXI, p. 36.  
1930. *Science*, LXXII, pp. 243-244.
- PELIKAN, A. 1896. *Tschm. Min. Mitth.*, XVI, pp. 1-65; XII, p. 481.
- POGGENDORF, J. C. 1841. *Pogg. Annalen*, LIV, p. 377.
- ROBINSON, S. 1825. 'A Catalogue of American Minerals with Their Localities.'  
Boston. Pp. 63, 95.
- SCHOOLCRAFT, H. R. 1824. *Amer. Jour. Sci.*, Ser. 1, VII, p. 48.
- SCOTT, A. 1914. *Mineralog. Mag.*, XVII, p. 104.
- STEINMETZ, H. 1925. *Zeits. Kryst.*, LXI, pp. 380-388.
- TARR, W. A. 1929. *Amer. Min.*, XIV, pp. 19-25.
- TARR, W. A., AND LONSDALE, J. T. 1929. *Amer. Min.*, XIV, pp. 50-53.
- TUTTON, A. E. H. 1911. *Jour. Royal Soc. Arts London*, LIX, pp. 1091-1100.  
1924. 'The Natural History of Crystals.' London. Pp. 206-210, Pls. XXV, XXVI.
- WADA, T. 1904. 'The Minerals of Japan.' Tokyo, p. 46.
- WHITLOCK, H. P. 1903. 'List of New York Mineral Localities,' New York State Mus. Bull. 70, pp. 34, 52.  
1905. New York State Mus. Bull. 98, p. 6.
- WILD, G. O., AND LIESEGANG, R. E. 1923. *Centralbl. Min.*, pp. 737-740.
- WOODWARD, J. 1729. 'An Attempt towards a Natural History of the Fossils of England.' London. I, pp. 157, 161.





MINERAL INCRUSTATIONS UPON THE EDGES AND  
CORNERS OF CRYSTALS

BY CLIFFORD FRONDEL

## ABSTRACT

Instances are described of mineral incrustations confined to the edges or corners of the incrustated crystals. The effect is explained by the greater adsorptive power of these portions of the crystal surface. Adsorption by the edges and corners of growing crystals may be accompanied by a change in crystal habit, modifying faces being developed which suppress the adsorbing edge or corner.

## PROPERTIES OF THE EDGES AND CORNERS OF CRYSTALS

The crystallization of one mineral upon another in the formation of a mineral incrustation is in general influenced by adsorption at the crystal—solution interface. Adsorption control of the super-crystallization may be manifested by the formation of an oriented incrustation; by the selective incrustation of a particular form of the incrustated crystal,<sup>1</sup> owing to the varying adsorptive power of different crystallographic directions; by the selective incrustation of one of several mineral species whose free crystals are exposed in an opening and are available for incrustation by a later formed mineral; and by the formation of incrustations localized to the edges or corners of the incrustated crystal.

The greater adsorptive power of the edges and corners of crystals as reflected by their ability to localize the crystallization of a substance upon them can be illustrated by experimental means. Edge incrustations of sodium nitrate upon calcite can be readily obtained by crystallizing a sodium nitrate solution upon freshly cleaved fragments of calcite. The sodium nitrate forms rhombohedrons disposed in parallel position along the edges of the calcite cleavage pieces. A paper by Bombicci<sup>2</sup> on the parallel growths formed by these two isomorphous substances contains twenty-odd figures which clearly illustrate the effect of the edges in localizing crystallization. The effect has also been re-

<sup>1</sup>Frondel, C. 1934. *Amer. Min.*, XIX, pp. 316-329.1934. *Amer. Mus. Novitates*, No. 695, pp. 1-6.<sup>2</sup>Bombicci, L. 1876. *Mem. Accad. Sci. Inst. Bologna*, Ser. 3, VII, p. 125.

marked on by Settele.<sup>1</sup> Similarly when sodium chloride is crystallized upon a fresh cleavage section of galena, the crystals may be observed to be aligned in parallel position along cleavage cracks or tear-lines on the cleavage surface.<sup>2</sup> A parallel alignment of sodium bromide crystals along the edges of cracks on a galena cleavage surface has also been figured<sup>3</sup>. Certain natural galena crystals contain small cavities filled with a sodium chloride solution, and when these crystals are cleaved, the solution spreads and crystallizes, producing lines of small halite crystals disposed in parallel position along curved tear-lines on the cleavage surface. Photographs of these edge growths have been published by Buerger<sup>4</sup> and by Head.<sup>5</sup> The crystallization of iodine from vapor has also been observed to be influenced by striations and rugosities on the condensing surface.<sup>6</sup>

Seemingly related to these occurrences are those in which the crystallization of a solution is initiated or localized by the scratching of the containing vessel. The effect is particularly well marked with ammonium magnesium phosphate and similar Mg salts and was early considered by Wollaston to be a test for Mg<sup>7</sup>. The crystallization of metastable forms may sometimes be induced in this way.<sup>8</sup>

Schwab and Pietsch<sup>9</sup> have shown by a photographic method that the adsorption of radio-elements by crocoite does not occur over the whole surface but takes place principally along the edges of the crystal. The use of certain aniline dyes in microchemical determinative methods based on the selective staining of the minerals of rock sections is limited by their tendency to indiscriminately stain rugosities and cracks on the section. This also appears to be an instance of edge and corner adsorption. An instance of edge and corner adsorption by a growing crystal of lead nitrate accompanied by habit change has been described by Gaubert.<sup>10</sup> This substance crystallizes as octahedrons from a pure water solution and as cubes from a solution containing methylene blue. When octahedrons are placed in a super-saturated solution containing methylene blue, the dye is adsorbed by the crystal corners and edges adjacent to the corners, hindering growth in these directions, and cubes are produced by overgrowth. Summaries of further evidence from many

<sup>1</sup>Settele, M. 1930. *Neues Jahrb. Min., Abt. A, Beil.-Bd. LXI*, p. 227.

<sup>2</sup>Sloat, C. A., and Menzies, A. W. C. 1931. *Jour. Phys. Chem.*, XXXV, p. 2006, Pl. 1.

<sup>3</sup>Grimm, H. G. 1924. *Zeits. Elektrochem.*, XXX, p. 469, fig. 4.

<sup>4</sup>Buerger, M. J. 1932. *Amer. Min.*, XVII, p. 228, fig. 1.

<sup>5</sup>Head, R. E. 1931. *Amer. Min.*, XVI, p. 349, fig. 3.

<sup>6</sup>Wulff, J. 1929. *Zeits. phys. Chem., Abt. B*, VI, p. 43.

<sup>7</sup>Waller, A. 1848. *Phil. Mag.*, XXVIII, p. 94.

<sup>8</sup>Gernoz, D. 1877. *Compt. rend.*, LXXXIV, pp. 1389-1392.

<sup>9</sup>Schwab, G. M., and Pietsch, E. 1929. *Zeits. phys. Chem., Abt. B*, II, pp. 262-263.

<sup>10</sup>Gaubert, P. 1926. *Revue gen. sci.*, XXXVII, p. 365.

diverse branches testifying to the greater adsorptive power of the edges and corners of crystalline substances are given by Frazer<sup>1</sup> and by Schwab and Pietsch.<sup>2</sup> The development of the subject is largely owing to workers in contact catalysis.

The effect of the edges and corners is accounted for in a theory proposed by Taylor,<sup>3</sup> which follows. The atoms composing a crystal surface are in varying degrees of saturation according to the degree to which their external fields are saturated by surrounding atoms. Atoms situated in a plane surface will have a certain degree of saturation on the free side. Those situated in the edges of the crystal will be one degree less saturated than the atoms in the plane surfaces, by reason of the fact that they are to a less degree surrounded by other atoms. For this reason the edges will possess stronger attractive forces for impinging atoms. This increased attractive force at an edge will be surpassed by that obtaining at a corner. The localization of the super-crystallization to the edges in the experimental examples mentioned is thus due to the adsorption of substance from solution on them to a greater degree than on the adjacent plane surfaces. This favors the formation of crystal nuclei upon them with the inception of crystallization. The edge and corner incrustations involving natural species to be described are similarly believed to be of this origin, with the possible exception of certain pyrite and marcasite incrustations upon calcite in which the deposition may have been controlled by chemical reaction with the incrustated crystal, the greater rate of solution of the edges acting to localize the deposition, and with the further exception of instances in which colloidal particles seem to have been directly adsorbed by the edges of the crystals.

The edges and corners of crystals are also distinguished in other ways. The greater rate of solution and more rapid growth of these portions of the crystal surface are well known. The edges are usually simply rounded off by solution but the action of the solvent sometimes results in the formation of narrow grooves or indentations along the crystal edges, as with quartz<sup>4</sup> and pyrite.<sup>5</sup> Raised edges are commonly observed on natural and artificial crystals of gold and other metals and also on quartz, galena and other species. Overgrowths of successive generations of different habit of a mineral frequently initiate upon the corners of the earlier crystals, as is notably the case with fluorite. The

<sup>1</sup>Frazer, J. W. C. 1930. *Jour. Phys. Chem.*, XXXIV, pp. 2133-2136.

<sup>2</sup>Schwab, G. M., and Pietsch, E. 1929. *Zeits. Elektrochem.*, XXXV, pp. 573-582.

<sup>3</sup>Taylor, H. S. 1925. *Proc. Royal Soc. London*, CVIII, A, pp. 105-111. 1926. *Jour. Phys. Chem.*, XXX, p. 150.

<sup>4</sup>Ichikawa, S. 1915. *Amer. Jour. Sci.*, Ser. 4, XXXIX, p. 455.

<sup>5</sup>Ichikawa, S. 1929. *Amer. Jour. Sci.*, Ser. 5, XVII, p. 251.

rough fracture surfaces of crystals yield more readily to solution than do the natural faces and are healed more rapidly during growth.

Experiments have been described<sup>1</sup> which have shown that certain chemical reactions take place more readily on the edges of crystals than over the plane surfaces. The localization of the reaction is due to the greater rate of solution of the edges rather than to adsorption. It is similarly found that bubbles of CO<sub>2</sub> appear chiefly along the edges and corners of alum crystals when they are immersed in solutions of carbonates. Crystals of sodium alum effloresce on the edges.

#### DESCRIPTION OF SPECIMENS<sup>2</sup>

##### DOLOMITE INCRUSTING RHODOCHROSITE

An oriented edge and corner incrustation of dolomite upon rhodochrosite very similar to the experimentally obtained edge incrustations of sodium nitrate upon calcite is shown by two specimens from the John Reed Mine, Alicante, Lake Co., Colorado. The rhodochrosite crystals are pale rose-red individuals composed of (10 $\bar{1}$ 1) and form druses in cavernous vein material. On one specimen rhodochrosite rhombohedrons up to 1 cm. on an edge are incrustated by minute (.5 mm.) dolomite rhombohedrons with a vitreous pearly appearance which are aligned in parallel position along the edges of the crystals, the faces themselves being free from deposition. On a number of the rhodochrosite crystals of this specimen the corners only are incrustated by the dolomite (Fig. 1); other crystals showed corner incrustations with one or two smaller isolated dolomite crystals disposed along the edges themselves. The second specimen is similar, but the dolomite crystals are slightly larger and are aggregated to form a continuous ridge along the edges of the incrustated crystals (Fig. 2).

The oriented growth of dolomite upon rhodochrosite has not been previously described.

##### FLUORITE INCRUSTING CALCITE

J. L. Smith<sup>3</sup> has described groups of calcite crystals of a scalenohedral habit from the Wheatley Mine, Chester Co., Pennsylvania, the apice of each crystal of which is tipped by a small crystal of fluorite, the remaining portions of the crystals being unincrustated. These crystals with their incrustation were overgrown during or after the crystalliza-

<sup>1</sup>Pietsch, E. Kotowski, A., and Berend, G. 1929. *Zeits. Elektrochem.*, XXXV, pp 582-586.

<sup>2</sup>The specimens described are contained in the collection of The American Museum of Natural History, unless otherwise stated.

<sup>3</sup>Smith, J. L. 1855. *Amer. Jour. Sci.*, Ser. 2, XX, p 252, fig. 4.

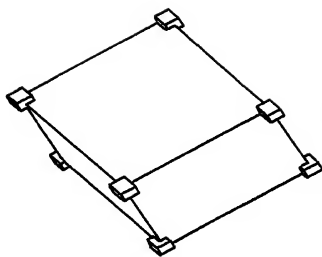


Fig. 1

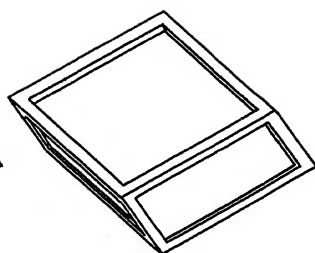


Fig. 2

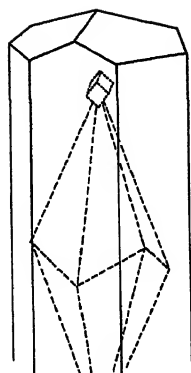


Fig. 3

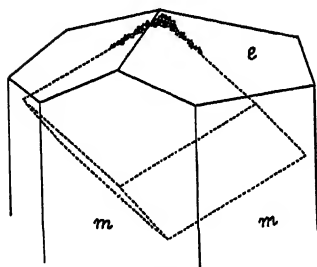


Fig. 4

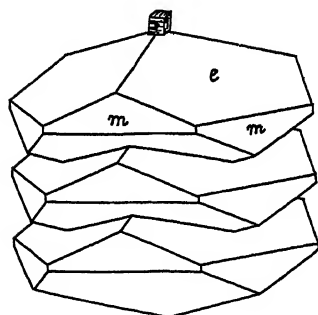


Fig. 5

Figs. 1, 2. Dolomite incrusting in parallel position the corners and edges of rhodochrosite. John Reed Mine, Alicante, Colorado.

Fig. 3. Fluorite tipping a calcite scalenohedron enclosed within an overgrowing crystal of different habit. Wheatley Mine, Chester Co., Pennsylvania.

Fig. 4. Marcasite incrusting the edges of a  $(10\bar{1}1)$  crystal of calcite that has been enclosed by overgrowth within a crystal formed of  $(10\bar{0}0)$  and  $(01\bar{1}2)$ . Przibram, Bohemia.

Fig. 5. Pyrite tipping the apex of a composite calcite crystal formed of  $(10\bar{1}0)$  and  $(01\bar{1}2)$ . The lower, overgrown, crystals are also tipped by pyrite. Przibram, Bohemia.

tion of the fluorite by calcite of a different habit (Fig. 3). Smith does not give the identity of the forms present on the crystals, but his figure, copied here, apparently consists of  $(21\bar{3}1)$  with  $(10\bar{1}0)$  and  $(01\bar{1}2)$  as the habit of the overgrowing calcite. It is not remarked if the fluorite is crystallographically oriented to the calcite but this does not appear to be the case.

#### MARCASITE INCRUSTING CALCITE

A specimen of calcite from Příbram, Bohemia, presents a group of  $(10\bar{1}1)$  rhombohedrons attached by one end of their vertical axis to the matrix with the exposed apice of the crystals, that is, the corner of the trihedral angle formed by  $(10\bar{1}1)$ ,  $(\bar{1}101)$  and  $(0\bar{1}11)$ , and the edges for a short distance away from the apice heavily incrustated by an aggregate of small platy crystals of marcasite. The middle edges and corners of the rhombohedrons and the faces themselves are free from incrustation. During or after the formation of the incrustation the crystals were overgrown by calcite that formed crystals composed of  $(10\bar{1}0)$  and  $(01\bar{1}2)$  (Fig. 4). The rhombohedrons range in size up to 1 cm. and the enclosing crystals are only slightly larger. The marcasite incrustation in part slightly projects above the surface of the later crystals.

#### PYRITE INCRUSTING CALCITE

##### Příbram, Bohemia

An extraordinary example of corner incrustation is afforded by two specimens from the Anna Mine, Příbram, Bohemia, which present drusy surfaces of thin tabular calcite crystals composed of  $(01\bar{1}2)$  modified by  $(10\bar{1}0)$  with the apice of each crystal tipped by a minute cube of pyrite (Fig. 5). The other corners and edges on the crystals and the faces themselves are entirely free from pyrite. The calcite crystals uniformly measure about 2 mm. across and have grown so that the vertical axis is approximately perpendicular to the incrustated wall rock. About 500 crystals are present on the two specimens and the incrustation is lacking from only about 50 of these. The great majority of the pyrite crystals are minute, the largest one seen measuring .3 mm. on an edge. Many of them consist of two or three closely interpenetrating individuals. Occasionally a considerable number of minute pyrite crystals are aggregated together and in these cases the pyrite mass extends from the apice down the edges of  $(01\bar{1}2)$  for a short distance. When single crystals of pyrite occur perched upon the calcite apice it can be seen that the two minerals are not definitely oriented to each other.

The calcite crystals frequently occur piled one on top of another, sometimes in alignment and forming a single but strongly composite crystal, as in Fig. 5, but generally in a random overlapping pile and it can be seen in such cases that each of the calcite crystals has a pyrite cube perched upon its summit. Sometimes six or seven calcite crystals, all of equal size, occur heaped up in this way, each covering an earlier pyrite-incrusted crystal. This behavior suggests periodicity in deposition.

#### Locality Unknown

A photograph of a group of rhombohedral calcite crystals with the corners and part of the edges adjacent to the corners heavily incrustated by pyrite has been published by Schwab and Pietsch<sup>1</sup> in connection with their discussion of adsorption by the edges and corners of crystals. The specimen is not described and the locality is not stated.

#### Rondout, New York

Whitlock<sup>2</sup> has described calcite from Rondout, Ulster Co., New York, in which the edges of crystals composed of (10 $\bar{1}$ 1) have been incrustated by an aggregate of minute crystals of pyrite. These crystals are overgrown by calcite crystals formed of (01 $\bar{1}$ 2) with (31 $\bar{4}$ 2) and (10.3.13.2) which preserve the incrustated crystals in their interior.

#### Rand, South Africa

Young<sup>3</sup> has noted that calcite crystals occurring in drusy cavities in veins cutting the Main Reef series in the Rand, South Africa, contain innumerable crystals of pyrite in their outer portions, giving the calcite a greenish tint, which have "very evidently been precipitated by preference on the edges and corners of the crystals."

#### Wheatley Mine, Pennsylvania

Edge incrustations of pyrite upon calcite have been described by Smith<sup>4</sup> from the Wheatley Mine, Chester Co., Penn., where they are found with the corner incrustations of fluorite upon calcite already mentioned. The occurrence is similar to the edge incrustation of marcasite upon calcite from Przibram, described earlier, in that calcite crystals formed of (10 $\bar{1}$ 1) were incrustated along the edges by minute crystals of pyrite, and these crystals with their incrustation were then enclosed in

<sup>1</sup>Schwab, G. M., and Pietsch, E., op. cit., fig. 4.

<sup>2</sup>Whitlock, H. P. 1910. N. Y. State Mus. Mem. 13, p. 124, Pl. xxvii, fig. 3.

<sup>3</sup>Young, R. B. 1910. Trans. Geol. Soc. South Africa, XII, p. 93.

<sup>4</sup>Smith, J. L., op. cit., fig. 6.



slightly larger calcite crystals of a habit dominantly formed by (10 $\bar{1}$ 0) and (01 $\bar{1}$ 2).

Smith further notes from this locality pyrite incrustations upon calcite which seem to represent a selective incrustation of the forms of a calcite crystal enclosed in a larger crystal of later growth<sup>1</sup> and also describes a singular aggregation of a large number of calcite crystals in the form of a closed double spiral, as if around an axis.

The localization of the sulphide incrustation to the edges and corners of the incrustated crystal in this and in the preceding instances and in the edge incrustation of marcasite upon calcite may possibly have resulted from the chemical reaction of the calcite with the sulphide solution, the greater rate of solution of the edges and corners of the crystals acting to localize the sulphide deposition. The absence of visible solution effects on the crystals studied at first hand, however, and the simultaneous deposition of the sulphide and the carbonate in the instances described from Przibram and the Rand and probably also in the instances accompanied by overgrowth, point to the adsorption by and simple crystallization upon the calcite by the sulphide. Marcasite has been described as being syncrystallized with calcite,<sup>2</sup> although marcasite ordinarily crystallizes from acid solutions in which calcite would be soluble, and pyrite and other sulphides are often found so.

#### TETRAHEDRITE AND CHALCOPYRITE INCRUSTING SPHALERITE

A group of nearly black crystals of sphalerite from Butte, Montana, presents distorted tetrahedrons repeatedly twinned on (111) with the edges of the crystals and the edges of the re-entrant angles formed by the twins marked by rows of minute tetrahedrite crystals in parallel alignment. On some crystals, ten or more parallel rows of tetrahedrite crystals are developed along the edges of the twinned lamellae. Triangular striations formed by terrace-like growth hillocks on the faces of the tetrahedrons are also occasionally outlined by rows of minute tetrahedrite crystals.

A suite of specimens from an unknown locality in the western United States presents successive incrustations of galena, sphalerite and tetrahedrite upon very large distorted crystals of chalcopryrite. The sphalerite for the most part forms large nearly transparent yellow green crystals

<sup>1</sup>An incrustation of pyrite selective upon the forms of a calcite crystal has been described by J. D. Dana (1844, *System of Min.*, 2d Ed., p. 93).

<sup>2</sup>Brewster, D. 1864. *Trans. Royal Soc. Edinburgh*, XXIII, p. 98.

Whitlock, E. P. 1910. *N. Y. State Mus. Mem.* 13, p. 106.

Lindgren, W. 1915. *U. S. Geol. Surv. Bull.* 601, p. 45.

Merwin, H. E. 1914. *Amer. Jour. Sci.*, Ser. 4, XXXVIII, pp. 355-359.

Fron del, C. 1934. *Amer. Mus. Nat. Hist. Novitates*, No. 895, pp. 5-6.

which have overgrown the chalcopyrite and the galena. The tetrahedrite, which was the last mineral to crystallize, forms small, sharply defined crystals that are markedly arranged, in parallel position, along striations formed by twinning and by vicinal growth on the surface of the sphalerite. A very minor amount of chalcopyrite crystallized out with the tetrahedrite and is similarly disposed along the striations. This later generation of chalcopyrite forms dull rough surfaces and rows which appear to the eye as consisting of irregular grains, but when such aggregates are viewed from certain angles, a satin-like sheen is seen which is due to a parallel orientation of minute crystal faces on the grains.

The galena, sphalerite and tetrahedrite in part occur as small isolated crystals situated on the early formed chalcopyrite crystals. The galena and the tetrahedrite are oriented to that species but the sphalerite is not. The galena forms cubo-octahedrons with (111) in contact with (111) of the chalcopyrite and with the crystal axes of the two minerals parallel to each other. The chalcopyrite is strongly striated but the distribution of the incrustation is not noticeably influenced by these edges or by the ordinary edges and corners of the crystals.

#### TETRAHEDRITE INCRUSTING CHALCOPYRITE

An edge incrustation of tetrahedrite upon chalcopyrite crystals, although not a striking one because of the small number of tetrahedrite crystals present, was observed on a specimen from Central City, Gilpin Co., Colorado. The chalcopyrite forms a large group of untarnished and strongly striated sphenoids, averaging 1 cm. in size, incrusting a matrix of quartz and pyrite. An oriented incrustation of tetrahedrite in small isolated crystals is present upon a few of the chalcopyrite crystals and is for the most part distributed along the edges of these and in a few instances is situated directly upon the corners.

Sadebeck<sup>1</sup> has described an oriented incrustation of tetrahedrite upon twinned "fivelings" of chalcopyrite from Meiseberg, Saxony, which is largely developed upon the corners of the incrustated crystals.

#### HEMATITE INCRUSTING CALCITE

Instances of edge adsorption by calcite crystals are found which differ from the previously described instances in that the deposited substance appears to have been directly adsorbed as colloidal particles from a sol which enveloped the crystals during or after their growth.

Complexly developed calcite crystals from West Paterson, N. J.,

---

<sup>1</sup>Sadebeck, A. 1872. Zeits. deutsch. geol. Ges., XXIV, p. 441, figs. 18, 19.

have been described on which the faces of a particular form are covered by a rose-red or rose-colored film of hematite which was adsorbed selectively by that form from an iron oxide sol which bathed the crystals at some time after the completion of their growth.<sup>1</sup> The edges of these filmed faces are strongly marked by a deep red line of hematite, the other edges of the crystal not being thus marked, and this edge deposition seems to represent the initial stage of formation of the film. On some crystals only the edges of these faces have received deposition, although then but slightly, while the faces themselves are unfilmed.

Three specimens of calcite from localities in Lancashire, England, present groups of crystals of a modified scalenohedral habit which contain inner scalenohedral crystals of calcite the edges of which are outlined by pulverulent hematite.<sup>2</sup> The hematite coating is not strictly confined to the crystal edges but is most dense there and rapidly decreases in intensity towards the interior of the faces. The coating is particularly heavy towards the apical part of the crystals. The habit of the inner, coated crystals in these instances is formed by simple (21 $\bar{3}$ 1) scalenohedrons. The overgrowing calcite differs in habit from this and forms crystals dominantly composed of (21 $\bar{3}$ 1) with small rounded and striated modifying faces of (10 $\bar{1}$ 1) and (01 $\bar{1}$ 2) in one of the instances and these two modifying forms with (13 $\bar{4}$ 1) also in the two other instances.

Calcite crystals showing inner crystals delineated by hematite or by a flocculent black substance were observed on a number of specimens from Cumberland, Derbyshire, Lancashire and other localities but without the feature of edge deposition described. Woodward<sup>3</sup> has catalogued calcite from a locality near Haddon, Derbyshire, as "Two Pieces of a pellucid Spar lineated with black in such manner, as to shew the Order and Succession of the Matter in the Formation of the Mass."

It is of interest to note that the habit change in these and in the previously described instances of calcite overgrowth accompanying an edge or corner adsorption is such as to suppress or render more obtuse the adsorbing edge or corner. The mechanism of the habit change, as in the experimental instance of edge and corner adsorption by a growing crystal of lead nitrate, mentioned earlier, appears to be by lowering the growth velocity of the edges and corners to such a value that one of the possible crystal forms residing in them can develop on the crystal.

<sup>1</sup>Fronzel, C., op. cit., pp. 3-5.

<sup>2</sup>A photograph of one of these specimens has been published by Whitlock (1933, Nat. Hist., XXXIII, p. 276).

<sup>3</sup>Woodward, J. 1729. An Attempt Towards a Natural History of the Fossils of England. London, I, p. 152.

## MISCELLANEOUS OCCURRENCES

Incrustations of chalcopyrite and of pyrite that are selective upon the (111) and (100) forms, respectively, of galena cubo-octahedrons have been described<sup>1</sup> in which the super-crystallization appears to have initiated upon the edges of the galena crystals and to have gradually extended from the edges over the whole area of the incrustated faces with increasing deposition. Smyth<sup>2</sup> has described incrustation pseudomorphs of pyrite after pyrrhotite in which the pyrite has built up as pronounced ridges upon the edges of the original pyrrhotite crystals, and Maier<sup>3</sup> has figured an instance in which an anglesite crystal projects in parallel growth from a corner of a barite crystal. An oriented edge incrustation of topaz upon trapezohedrons of spessartite, from the Thomas Range, Utah, has been briefly described by Montgomery.<sup>4</sup> A crystal of zircon from Iron Mountain, New York, has been described by Whitlock<sup>5</sup> as having gray zones of hematite or magnetite dust symmetrically disposed along certain of its edges.

Fluorite crystals are frequently noted to be more intensely pigmented along the edges of the crystals or to have the edges outlined by a pigment of a different color. Brauns<sup>6</sup> has figured fluorite cubes of a yellow color the edges of which are marked by a line of violet color and also colorless octahedrons that are blue on the corners. Several similar instances were observed on specimens in the Museum collection. The interior segments or "growth pyramids" beneath the different growth forms of single crystals of fluorite are sometimes found to be unequally pigmented, or differently pigmented, as a result of the unequal adsorbing power of the different forms,<sup>7</sup> and a continuance of crystal growth in these instances of edge and corner coloration would probably also result in the appearance of a selectively colored modifying form on the adsorbing edge or corner.

<sup>1</sup>Fron del, C. 1934. *Amer. Min.*, XIX, pp. 322-323.

<sup>2</sup>Smyth, C. H. 1911. *Amer. Jour. Sci.*, Ser., 4, XXXII, pp. 156-160.

<sup>3</sup>Maier, A. 1923. *Zeits. Kryst.*, LVIII, p. 98, fig. 12.

<sup>4</sup>Montgomery, A. 1934. *Amer. Min.*, XIX, p. 88.

<sup>5</sup>Whitlock, H. P. 1907. *N. Y. State Museum Bull.* 107, p. 86, Pl. vi, fig. 13b.

<sup>6</sup>Brauns, R. 1903. *Das Mineralreich* (translated by L. J. Spencer, London, 1912), p. 375, Pl. LXXI, figs. 2, 12.

<sup>7</sup>Fron del, C. 1934. *Amer. Mus. Novitates*, No. 758, p. 6.



59.51, 8 L (74.1)

THE DISTRIBUTION OF ROTIFERA ON MOUNT DESERT  
ISLAND. PART VI<sup>1</sup>NEW BRACHIONIDAE OF THE GENUS *LEPADELLA*<sup>2</sup>

BY FRANK J. MYERS

The rotatorian fauna of Mount Desert Island proved to be very rich in lepadellids, particularly in those species that lurk or live among the leaves of submerged aquatic mosses, especially *Sphagnum*. From such habitats all of the species herein described were collected. Individuals were studied from fully contracted specimens, as the anterior margins, obscured in expanded animals, offer some of the salient characters in the determination of species. No detailed study of the corona or the trophi was made, as they are very uniform throughout the genus. The corona is of the typical family type with the circumapical band suppressed dorsally because of the protective "head-hood." The mastax is malleate.

No observations were made on the sensory pit, situated dorsally on the terminal foot joint. As Harring (1) observed, "this sensory pit has not been demonstrated in all the species, but has been found in all cases where it was possible to obtain a properly oriented view under sufficient magnification." The presence of a caudal ganglion among the rotifers has been demonstrated and it is not unreasonable to suppose that the sensory setae of the pit are connected with the ganglion by a nerve thread, as in other genera.

The lateral antennae, which emerge through simple openings on the dorsal plate near the posterior end, are very uniform throughout the genus; no mention has been made of them in the descriptions, except in one instance which is explained in the text.

The eight new species and two new varieties described in this paper are as follows:

*Lepadella bractea**Lepadella apsicora**Lepadella venefica**Lepadella zenica**Lepadella longiseta**Lepadella visenda**Lepadella triba**Lepadella latusinus* var. *americana**Lepadella akroboles**Lepadella triptera* var. *alata*

<sup>1</sup>The preceding parts of this article appeared in American Museum Novitates as follows: part I (not numbered) in No. 494, Sept. 28, 1931; part II in No. 659, Sept. 15, 1933; part III in No. 680, Sept. 15, 1933; part IV in No. 699, March 10, 1934; part V in No. 700, March 10, 1934.

<sup>2</sup>In this and the following paper of the Mount Desert series, the classification of Remane (Bronn's Tierreich, IV, Abt. II, Buch 1, Rotatorien, Gastrotrichen und Kinorhynchen, pp. 514-517), has been followed. I consider this the most natural and logical classification thus far proposed.

## ORDER MONOGONONTA

## Family Brachionidae

*Lepadella bractea*, new species

Figures 1, 2, 3

The body is subcircular in outline, deep, strongly convex dorsally and evenly arched; it is prolonged posteriorly into a small pointed projection. There is a prominent dorsal, zigzag keel arising near the anterior margin and extending the full length of the dorsum. The dorsal sinus is broadly U-shaped and has a well-marked stippled collar. The ventral sinus is about twice as deep as the dorsal, and has an inconspicuous line running parallel to it marking the collar limit.

The foot groove is elongate-oval in shape and rather short and narrow; its width is little more than one-half of the length. The terminal foot joint is almost equal to the combined length of the first and second joints. The toes are relatively short and taper gradually to acute points.

Length of lorica, 78 $\mu$ ; foot groove, 21 $\mu$ ; foot, 18 $\mu$ ; terminal foot joint, 9 $\mu$ ; toes, 21 $\mu$ . Width of lorica, 68 $\mu$ ; anterior points, 25 $\mu$ . Depth of dorsal sinus, 12 $\mu$ ; ventral sinus, 24 $\mu$ .

*Lepadella bractea* was fairly common throughout the island; it has also been collected in Atlantic County, New Jersey, and Vilas County, Wisconsin. The species is easily recognized by the prominent dorsal zigzag keel which gives the impression of being too long for the body and having become compressed longitudinally in order to fit. It is, however, a natural and permanent character and every individual, including those from New Jersey and Wisconsin, was thus provided.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 80.

*Lepadella venefica*, new species

Figures 4, 5, 6

The body is ovate in outline, fairly deep and evenly arched dorsally. The anterior margin is straight and there is no stippled collar present. The ventral sinus is deep and broadly U-shaped; it is provided with a flaring collar, but no stippling was observed.

The foot groove is wide and parallel-sided. The terminal foot joint is slightly longer than the combined length of the first and second joints. The toes are short, fairly stout and taper regularly to acute tips.

Length of lorica, 57 $\mu$ ; foot groove, 15 $\mu$ ; foot, 15 $\mu$ ; terminal foot joint, 7 $\mu$ ; toes 14 $\mu$ . Width of lorica, 47 $\mu$ ; anterior points, 20 $\mu$ . Depth of ventral sinus, 10 $\mu$ .

*Lepadella venefica* was evenly distributed throughout the island; it is also common in Atlantic County, New Jersey. This is one of the smaller species, being only slightly larger than *Lepadella triptera* Ehrenberg. Like that species it is so small that it is difficult to find, and is probably more common than the published records indicate. It differs

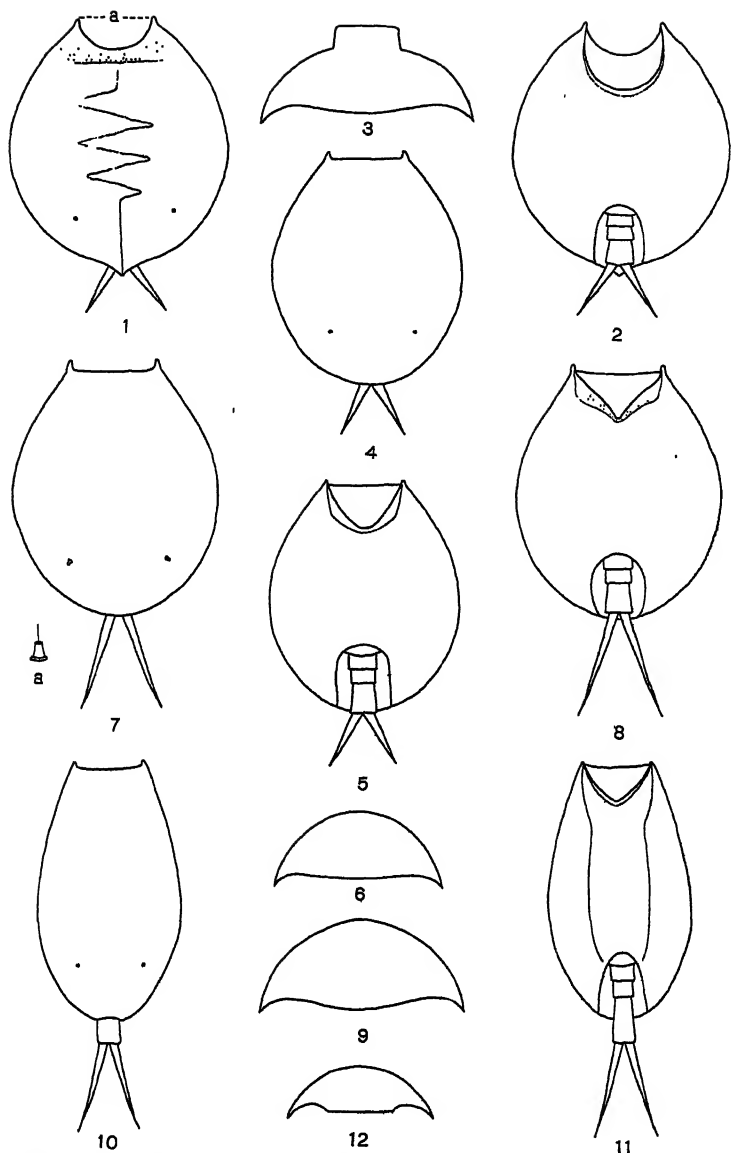


Fig. 1. *Lepadella bractea*, dorsal view. a, anterior points. Fig. 2. Ventral view. Fig. 3. Cross section of body. Fig. 4. *Lepadella venefica*, dorsal view. Fig. 5. Ventral view. Fig. 6. Cross section of body. Fig. 7. *Lepadella longiseta*, dorsal view. a, lateral antenna. Fig. 8. Ventral view. Fig. 9. Cross section of body. Fig. 10. *Lepadella triba*, dorsal view. Fig. 11. Ventral view. Fig. 12. Cross section of body.



chiefly from the above-mentioned species in the absence of a dorsal keel and in having a straight anterior, dorsal margin.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 382.

***Lepadella longiseta*, new species**

Figures 7, 8, 9

The lorica is ovate in outline, deep and evenly arched dorsally. The dorsal anterior margin is straight and no stippled collar was observed. The ventral sinus is deep and broadly V-shaped; it is provided with a prominent stippled collar, the edges of which are broadly flaring.

The lateral antennae are in the normal position, and the sensory setae emerge from the tips of small tubules.

The foot groove is relatively short and oval in outline. The terminal foot joint is slightly longer than the combined length of the first and second joints. The toes are relatively very long and slender, tapering regularly from the base to very slender tips.

Length of lorica,  $78\mu$ ; foot groove,  $20\mu$ ; foot,  $18\mu$ ; terminal foot joint,  $12\mu$ ; toes,  $38\mu$ . Width of lorica,  $65\mu$ ; anterior points,  $28\mu$ . Depth of ventral sinus,  $16\mu$ .

*Lepadella longiseta* is evidently rare. Two specimens were found in the Witch Hole during the summer of 1930. This species is related to *Lepadella benjamini* Harring, from which it differs in its much smaller size. While the depth of the body is ample, it is not nearly so deep relatively as that of the above-mentioned species, nor do the edges of the lorica overhang.

The lateral antennae are characteristic. The tubules, from the tips of which emerge sensory setae, are quite small, yet they are conspicuous enough to be easily seen, and are the only instance of this kind among the different species of the genus.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 738.

***Lepadella triba*, new species**

Figures 10, 11, 12

The body is very elongate and oval; it is shallow and evenly arched dorsally. The anterior margin is nearly straight and there is no stippled collar. The ventral sinus is broadly V-shaped, with an inconspicuous line running parallel to it marking the collar limit. The venter is provided with a very low, rounded elevation, and in cross section somewhat resembles the lorica of *Euchlanis*. However, there are no lateral sulci, the entire ventral plate being hardened.

The foot groove is flaring. The terminal foot joint is almost equal to one-half the length of the toes. The toes are long and taper regularly to very slender, drawn out tips.

Length of lorica,  $80\mu$ ; foot groove,  $20\mu$ ; foot,  $26\mu$ ; terminal foot joint,  $14\mu$ ; toes,  $32\mu$ . Width of lorica,  $45\mu$ ; anterior points,  $24\mu$ . Depth of ventral sinus,  $12\mu$ .

*Lepadella triba* was found in a pool on Pond Heath, where several specimens were collected during the summer of 1926. It is readily distinguished from the remaining species of the genus by the very elongate lorica and the peculiar *Euchlanis*-like formation of the ventral plate.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 670.

### ***Lepadella akrobeles*, new species**

Figures 13, 14, 15

The body is elongate and oval in outline; it is shallow and has a low rounded dorsal elevation, widest near the anterior margin, then gradually diminishing in breadth to the posterior margin, where it ends in the form of a low flange. The anterior dorsal margin is very shallow and there are no indications of a stippled collar. The ventral sinus is broadly V-shaped and has an inconspicuous line running parallel to it, which marks the collar limit.

The foot groove is narrow and parallel-sided. The terminal foot joint is slightly longer than the combined length of the first and second joints. The toes are short and rather stout; they taper gradually to very slender tips.

Length of lorica,  $90\mu$ ; foot groove,  $26\mu$ ; foot,  $22\mu$ ; terminal foot joint,  $12\mu$ ; toes,  $24\mu$ . Width of lorica,  $68\mu$ ; anterior points,  $28\mu$ . Depth of ventral sinus,  $15\mu$ .

*Lepadella akrobeles* was collected sparingly in an old, abandoned ice pond near Manset, during the summer of 1930. The peculiar shape of the dorsal elevation is distinctive and distinguishes it from any other species of the genus.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 723.

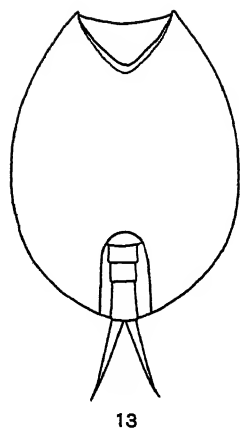
### ***Lepadella apsicora*, new species**

Figures 16, 17, 18

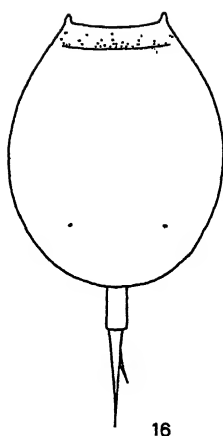
The body is oval in outline, shallow, and evenly arched dorsally. The dorsal anterior margin is nearly straight and there is a prominent stippled collar. The ventral sinus is deep and broadly V-shaped; it is also provided with a prominent flaring collar which is stippled throughout.

The foot groove is wide and slightly flaring posteriorly. The terminal foot joint is extremely long, being nearly twice the combined length of the first and second joints; it is twisted, as in *Lepadella cyrtopus* Harring, so that the left toe is almost directly under the right. The toes are strongly asymmetric, the right being nearly twice as long as the left.

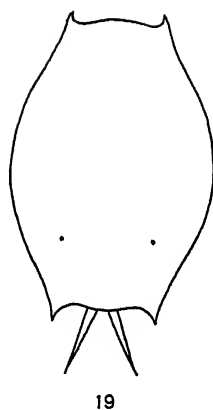
Length of lorica,  $80\mu$ ; foot groove,  $21\mu$ ; foot,  $30\mu$ ; terminal foot joint,  $20\mu$ ; right toe,  $30\mu$ ; left toe,  $14\mu$ . Width of lorica,  $65\mu$ ; anterior points,  $28\mu$ . Depth of ventral sinus,  $18\mu$ .



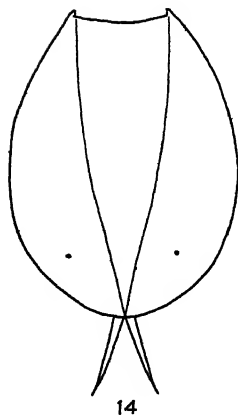
13



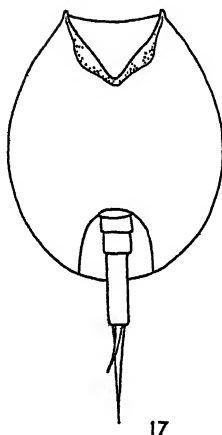
16



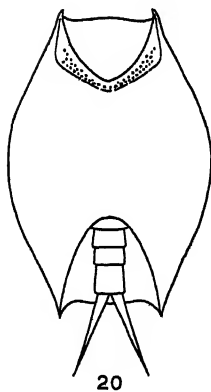
19



14



17



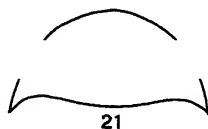
20



15



18



21

Fig. 13. *Lepadella akrobeles*, ventral view. Fig. 14. Dorsal view. Fig. 15. Cross section of body. Fig. 16. *Lepadella apsicora*, dorsal view. Fig. 17. Ventral view. Fig. 18. Cross section of body. Fig. 19. *Lepadella latusinus* var. *americana*, dorsal view. Fig. 20. Ventral view. Fig. 21. Cross section of body.

*Lepadella apsicora* was collected sparingly in the Witch Hole and Aunt Bettie Pond during several summers. Its nearest relative is *Lepadella cyrtopus* Harring, from which it differs mainly in the shape of the ventral sinus and in the relatively longer toes. In *Lepadella apsicora* the terminal foot joint is by far the longest, while the second foot joint is the longest in *Lepadella cyrtopus*.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 675.

***Lepadella latusinus* var. *americana*, new variety**

Figures 19, 20, 21

The body is subrhomboidal in outline, and deeply and evenly arched dorsally. The dorsal anterior margin is slightly excavate and the outline is somewhat convex in the middle portion. No dorsal stippled collar was observed. The ventral sinus is deep, broadly V-shaped, and has a prominent flaring collar which is stippled throughout. The posterior margin of the dorsum is wide and flaring, slightly excavate and convex in the middle portion.

The foot groove is deep and widely flaring. The length of the terminal foot joint is nearly equal to the combined length of the first and second joints. The toes are of medium length and gradually taper to very acute tips.

Length of lorica, 90 $\mu$ ; foot groove, 24 $\mu$ ; foot, 19 $\mu$ ; terminal foot joint, 9 $\mu$ ; toes, 24 $\mu$ . Width of lorica, 63 $\mu$ ; anterior points, 25 $\mu$ . Depth of ventral sinus, 20 $\mu$ .

This variety is fairly common on the island, and also in Atlantic County, New Jersey. It is smaller than *Lepadella latusinus* (Hilgendorf)<sup>1</sup> and has relatively shorter toes. The lateral angles of the posterior margin are very acute; they never curve outward and forward as in the exuberant forms of *Lepadella latusinus*. This variety is constant. Specimens from Mount Desert Island and New Jersey were found to agree in all respects.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 761.

***Lepadella xenica*, new species**

Figures 22, 23, 24

The body is pyriform in outline, the greatest width being near the anterior margin, from whence it diminishes gradually, and is prolonged posteriorly as a bluntly pointed projection. The body is shallow. A low elevation arises near the anterior margin of the dorsum, diminishing gradually in width and ending in a low flange. The lateral edges of the lorica overhang slightly. The dorsal sinus is fairly deep and surrounded by a prominent stippled collar, the beads of which are more strongly marked, with one possible exception, than any other known species of the genus. The ventral sinus is somewhat greater in depth than the dorsal and is equally as well marked by a stippled collar.

<sup>1</sup>See Harring, 1916, Proc. U. S. Nat. Mus., LI, p. 542, Pl. xci, figs. 7-12.

The foot groove is deep, quite narrow anteriorly and flaring posteriorly. The foot is relatively short and the terminal joint is somewhat longer than the combined length of the first and second joints. The toes are very long; they diminish gradually to extremely slender, drawn-out tips.

Length of lorica, 90 $\mu$ ; foot groove, 32 $\mu$ ; foot, 25 $\mu$ ; terminal foot joint, 12 $\mu$ ; toes, 45 $\mu$ . Width of lorica at widest part, 70 $\mu$ ; anterior points, 35 $\mu$ . Depth of dorsal sinus, 15 $\mu$ ; ventral sinus, 21 $\mu$ .

*Lepadella xenica* was collected in Aunt Bettie Pond during the summer of 1927. It bears some resemblance to *Lepadella hyalina* Smirnov, but differs from that species by having a much deeper dorsal sinus and also in the general shape of the body, particularly the posterior portion. It also somewhat resembles *Lepadella myersi* Edmondson. It differs from that species by being much more shallow dorsoventrally; by having a deep V-shaped anterior dorsal sinus, instead of being straight; by having relatively much longer toes lying side by side, instead of the left being under the right; and by having a rounded posterior projection, instead of being squarely truncate posteriorly. In both species the beaded stippling of the collar is very prominent.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 669.

#### ***Lepadella visenda*, new species**

Figures 25, 26, 27

The body is moderate in depth and is subrhomboidal in outline. The dorsum is evenly arched. The anterior dorsal margin is slightly convex and no stippled collar is present. The ventral sinus is deep and roughly U-shaped; there is an inconspicuous line parallel to it marking the collar limit. The posterior margin of the dorsal plate is flaring and bounded laterally by prominent blunt points.

The foot groove is deep, the anterior half narrow, the posterior half flaring. The terminal foot joint is about equal to the combined length of the first and second joints. The toes are long, the outer edges being straight; the inner edges are expanded at the base, then diminish gradually to form very slender tips.

Length of lorica, 108 $\mu$ ; foot groove, 36 $\mu$ ; foot, 22 $\mu$ ; terminal foot joint, 12 $\mu$ ; toes, 45 $\mu$ . Width of lorica, 75 $\mu$ ; anterior points, 32 $\mu$ . Depth of ventral sinus, 28 $\mu$ .

*Lepadella visenda*, while not common, is evenly distributed throughout the island. It has also been collected sparingly in Atlantic County, New Jersey. The species bears a certain resemblance to *Lepadella latusinus*, but differs mainly in the very long slender toes, bulbous at the base, and in the blunt lateral projections of the posterior margin.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 668.

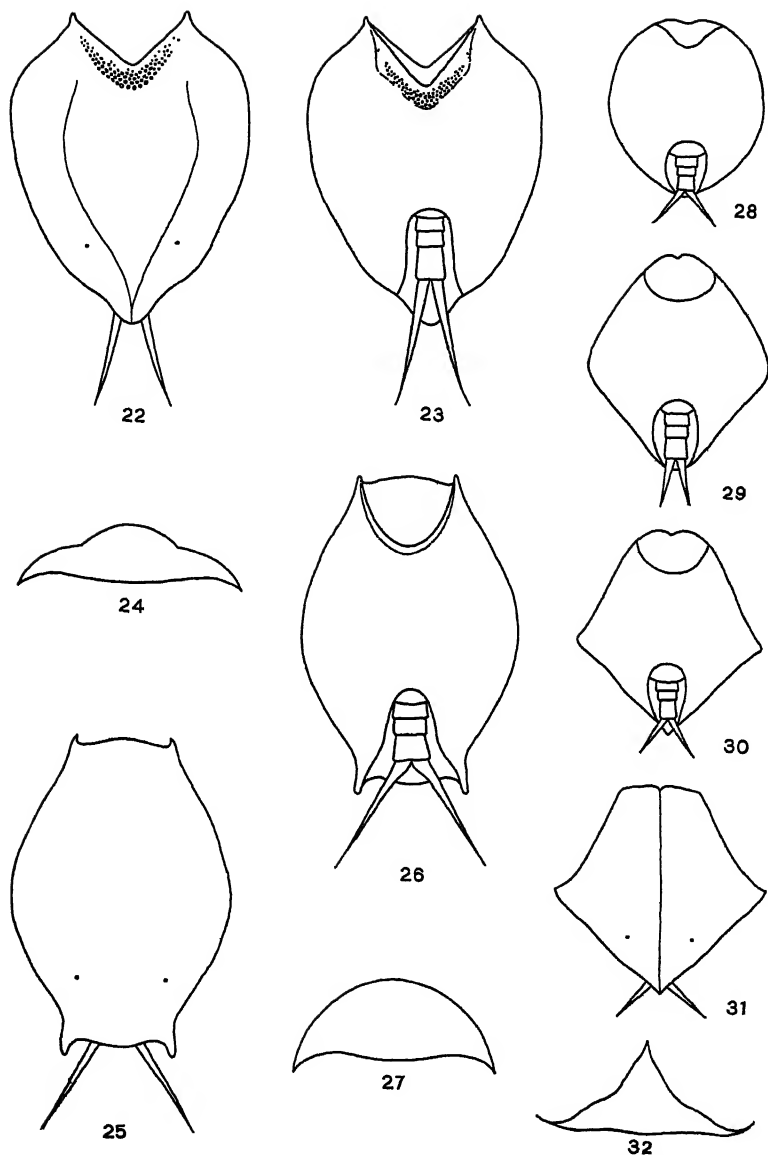


Fig. 22. *Lepadella xenica*, dorsal view. Fig. 23. Ventral view. Fig. 24. Cross section of body. Fig. 25. *Lepadella visenda*, dorsal view. Fig. 26. Ventral view. Fig. 27. Cross section of body. Fig. 28. *Lepadella triptera*, normal form, ventral view. Fig. 29. Mount Desert Island specimen, ventral view. Fig. 30. Karlsruhe specimen, ventral view. Fig. 31. *Lepadella triptera* var. *alata*, dorsal view. Fig. 32. Cross section of body. The figures of this variety are on a smaller scale than those of the other species.

***Lepadella triptera* var. *alata*, new variety**

Figures 28, 29, 30, 31, 32

*Lepadella triptera* Ehrenberg<sup>1</sup> is evidently quite variable. The normal form is constant in a circumscribed locality, and it is only when material from widely separated locations is brought together and compared that the different forms are seen to intergrade. The extreme of such a series should be accorded varietal rank, and it seems that *Lepadella triptera* var. *alata* is the extreme of the exuberant forms.

Figure 28 shows the normal form. Figures 29, 30, and 31 show the overlapping forms culminating in the winged variety, *alata*. Figures 28 and 29 are reproduced from drawings kindly sent by H. Hauer who collected the specimens near Karlsruhe, Baden.

Measurements of specimen shown in figure 8, material from Duck Brook, Mount Desert Island, are: Length of lorica, 80 $\mu$ ; foot groove, 25 $\mu$ ; foot, 20 $\mu$ ; terminal foot joint, 10 $\mu$ ; toes, 15 $\mu$ . Width of lorica, 72 $\mu$ . Depth of ventral sinus, 20 $\mu$ . Measurements of normal specimen: Length of lorica, 75 $\mu$ ; foot groove, 25 $\mu$ ; foot, 23 $\mu$ ; terminal foot joint, 10 $\mu$ ; toes, 20 $\mu$ . Width of lorica, 64 $\mu$ . Depth of ventral sinus, 14 $\mu$ .

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 762.

**ADDITIONS TO THE MOUNT DESERT ISLAND FAUNAL LIST**

Since the faunal list of rotatorian species of Mount Desert Island was published in the American Museum Novitates (No. 494, September, 1931), the following species have been added: *Collothea atrochoides* (Wierzejski), Witch Hole, and *Voronkovia mirabilis* Fadeew, from The Tarn.

**BIBLIOGRAPHY**

- (1) HARRING, H. K. 1916. 'A Revision of the Rotatorian Genera *Lepadella* and *Lophocharis* with descriptions of five new species.' Proc. U. S. Nat. Mus., No. 2164, LI, pp. 527-568, Pls. LXXXIX-XCVII.
- (2) REMANE, A. 1929-1933. 'Rotatorien, Gastrotrichen und Kinorhynchen.' Bronn's 'Kl. und Ordn. des Tierr.' IV, Abt. II, Buch 1, Lief. 1-4, pp. 1-576, Figs. 1-332.

---

<sup>1</sup>See Harring, 1916, Proc. U. S. Nat. Mus., LI, p. 560, Pl. xcv, figs. 1-4.







59.51, 8 T (74.1)

THE DISTRIBUTION OF ROTIFERA ON MOUNT DESERT  
ISLAND. PART VII<sup>1</sup>NEW TESTUDINELLIDAE OF THE GENUS *TESTUDINELLA* AND A NEW  
SPECIES OF BRACHIONIDAE OF THE GENUS *TRICHOTRIA*

BY FRANK J. MYERS

As was the case with several other genera, the waters of Mount Desert Island contained an unsuspected number of new testudinellids.

The anatomy and the trophi are very constant throughout the genus. The salient characters are to be found in the lorica of fully contracted specimens. They are: the general shape and size, the shape of the anterior and mental margins, the position of the lateral antennae, the position and shape of the foot opening, and the shape of the transverse section of the body. The trophi are of the malleo-ramate type.

The new species described in this paper are as follows:

<i>Testudinella angulata</i>	<i>Testudinella dentata</i>
<i>Testudinella triangularis</i>	<i>Testudinella ovata</i>
<i>Testudinella epicopta</i>	<i>Testudinella dicella</i>
<i>Trichotria eukosmeta</i>	

## ORDER MONOGONONTA

## Family Testudinellidae

*Testudinella angulata*, new species

Figures 1, 2

The lorica is roughly triangular and ovate, narrowest anteriorly, then gradually widening to a position marked by the lateral spines. The posterior portion is evenly rounded and marked by a median blunt projection of the foot opening. There are a pair of lateral spinules situated at the point of the greatest body width. The dorsal anterior margin is roughly trilobed, the median lobe being more prominent and acute than the lateral lobes. The mental margin is undulate; it has a small blunt median lobe bounded by larger laterals.

The lateral antennae are situated on the dorsum about half way between the anterior and posterior margins of the lorica.

The foot opening is elongate, oval, and terminal.

<sup>1</sup>The preceding parts of this article appeared in American Museum Novitates as follows: part I (not numbered) in No. 494, Sept. 28, 1931; part II in No. 659, Sept. 15, 1933; part III in No. 660, Sept. 15, 1933; part IV in No. 699, March 10, 1934; part V in No. 700, March 10, 1934; part VI in No. 760.

The transverse section of the lorica is greatly depressed and its exact shape will best be understood by reference to figure 2.

Length of lorica, 130 $\mu$ . Width of lorica at widest part, 90 $\mu$ ; anterior margin, 60 $\mu$ .

*Testudinella angulata* was fairly common throughout the island in association with submerged *Sphagnum* and *Fontinalis*. It has also been collected in Vilas County, Wisconsin, and in Atlantic County, New Jersey.

In *Testudinella parva* (Ternetz), lateral spines may be present or absent. The form having lateral spines is now recognized as a variety and is known as *Testudinella parva bidentata* (Ternetz). In *Testudinella angulata* the lateral spines are constant and always present.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 390.

#### ***Testudinella triangularis*, new species**

Figures 3, 4

The body is roughly triangular and ovate in shape. The posterior portion is truncate, slightly rounded and marked by a median notch of the foot opening. There are a pair of lateral spines, situated relatively lower down than in the preceding species, and nearly opposite the anterior limit of the foot opening. The dorsal anterior margin projects strongly, is bluntly pointed and has a median notch dividing it into two lobes. The mental margin is excavate and widely V-shaped. The lateral antennae are situated low down in the lumbar region.

The foot opening is subsquare and terminal.

The transverse section is triangular; the lateral edges are rounded and there is a low median keel extending the entire length of the venter.

Length of lorica, 120 $\mu$ . Width of lorica at widest part, 88 $\mu$ ; anterior margin, 40 $\mu$ .

Although *Testudinella triangularis* was not as common as the preceding species, it was evenly distributed throughout the Island in similar associations. It has also been collected in Atlantic County, New Jersey, and was abundant in Wheeler Lake, Vilas County, Wisconsin, during several summers. It bears a superficial resemblance to *Testudinella angulata*, but differs from that species principally in the anterior margins and in the transverse section of the lorica.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 760.

#### ***Testudinella epicopta*, new species**

Figures 5, 6

The body is squarely truncate anteriorly and posteriorly, widest in front and diminishing gradually from mid-length to the foot opening. The anterior dorsal margin is nearly straight; the mental margin is slightly undulate and has a shallow central

notch. The lateral antennae are situated nearly opposite the middle of the longitudinal body axis.

The foot opening is narrow, very wide and terminal.

The transverse section of the lorica is relatively stout; its exact shape will best be understood by reference to figure 6.

Length of lorica, 90 $\mu$ . Width of body at widest part, 75 $\mu$ ; anterior margin, 65 $\mu$ .

*Testudinella epicopta* was evenly distributed throughout the island. It is commensal on the cladoceran *Acantholeberis curvirostris*, and was generally found attached, by the ciliated tip of the foot, to the posterior portion of the carapace. It has also been collected in Atlantic County, New Jersey, and in Vilas County, Wisconsin.

This is not the only species of the genus that has developed the habit of commensalism. *Testudinella elliptica* Ehrenberg, *Testudinella caeca* (Parsons) and *Testudinella truncata* (Gosse), are to be found attached to the legs and gill plates of *Asellus*.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 455.

### ***Testudinella dentata*, new species**

Figures 7, 8

The body is ovoid and truncate anteriorly. The dorsal anterior margin is convex and projects in the form of two low lobes. The mental edge is slightly undulate and has a deep median sinus bounded by two acute spines. The lateral antennae are situated slightly above the median transverse body axis.

The foot opening is narrow and situated on the posterior fifth of the venter.

The transverse section of the body is much compressed, stouter in the middle portion and rounded at the lateral edges.

Length of lorica, 150 $\mu$ . Width of lorica at widest part, 90 $\mu$ ; anterior margin, 75 $\mu$ .

*Testudinella dentata* was common in brackish water near the outlet of the Barcelona at Thomas Cove. It has also been collected in brackish water in Powell's Creek, Atlantic County, New Jersey. It bears a certain resemblance to *Testudinella clypeata* Ehrenberg, which also has been found in salt and brackish water. It differs from that species in having a notched anterior margin, instead of being simply convex; the transverse section of the lorica is symmetric both dorsally and ventrally, instead of being convex dorsally and having a much smaller convex ventral side.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 140.

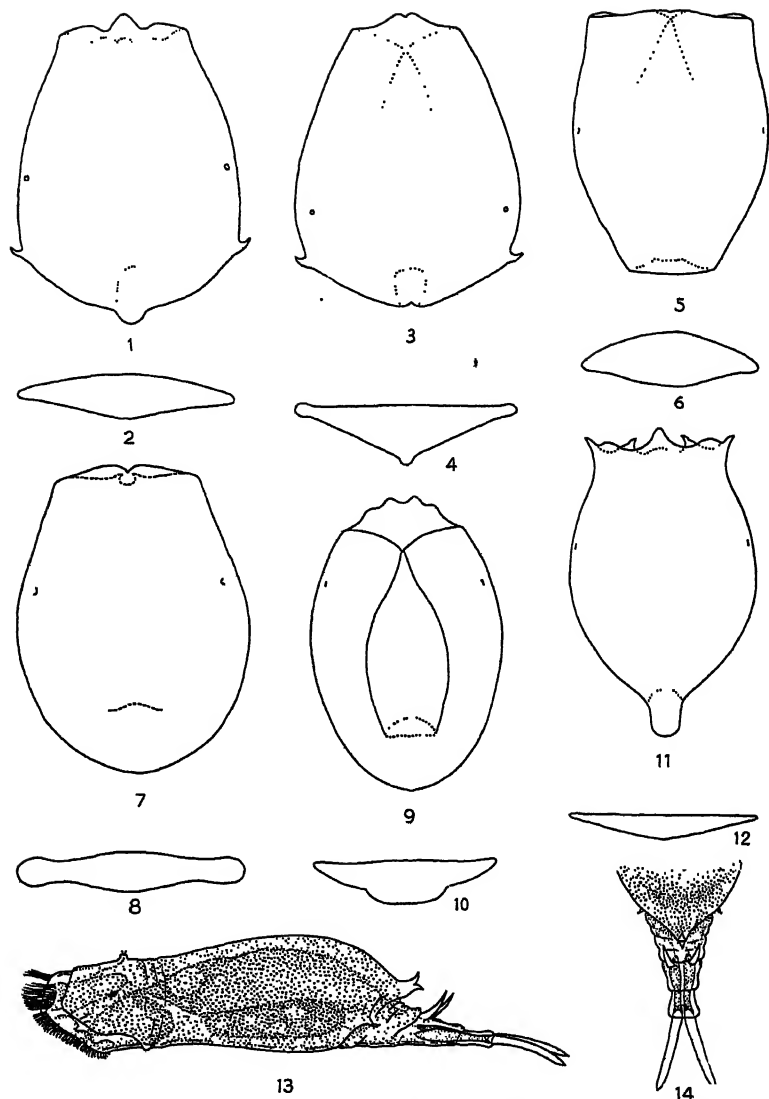


Fig. 1. *Testudinella angulata*, dorsal view of lorica. Fig. 2. Transverse section. Fig. 3. *Testudinella triangularis*, dorsal view of lorica. Fig. 4. Transverse section. Fig. 5. *Testudinella epicopta*, dorsal view of lorica. Fig. 6. Transverse section. Fig. 7. *Testudinella dentata*, dorsal view of lorica. Fig. 8. Transverse section. Fig. 9. *Testudinella ovata*, dorsal view of lorica. Fig. 10. Transverse section. Fig. 11. *Testudinella dicella*, dorsal view of lorica. Fig. 12. Transverse section. Fig. 13. *Trichotria eukosmeta*, lateral view. Fig. 14. Dorsal view of posterior portion of body. Dotted lines are features of the venter.

**Testudinella ovata**, new species

Figures 9, 10

The body is elongate and oval in shape. The dorsal margin is strongly convex and disposed into four prominent lobes. The mental margin is excavate and widely V-shaped. The lateral antennae are situated nearly opposite the first third of the longitudinal body axis.

The foot opening is wide and semicircular in shape; it is situated on the posterior fifth of the venter. There is a low ventral elevation, starting at the apex of the V-shaped mental margin, which gradually widens and terminates at the foot opening.

The transverse section of the lorica is nearly straight dorsally and bluntly keeled ventrally: its exact shape will best be understood by reference to figure 10.

Length of lorica, 125 $\mu$ . Width of lorica at widest part, 90 $\mu$ ; anterior margin, 55 $\mu$ .

*Testudinella ovata* was not common. A few specimens were collected in several locations at different intervals, always in association with submerged *Sphagnum*.

The projecting four-lobed anterior margin and the longitudinal ventral elevation readily distinguish this from any other species of the genus.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 739.

**Testudinella dicella**, new species

Figures 11, 12

The lorica is greatly depressed, urn-shaped, and has a prominent median, posterior, subsquare projection. The dorsal anterior margin is undulate; it is bounded laterally by two out-curved spines and has a prominent angular, median projection. The mental margin is undulate and has a wide subsquare median sinus bounded laterally by two blunt spines. The lateral antennae are situated somewhat above the median transverse body axis.

The foot opening is terminal and protected dorsally by a prominent subsquare projection of the dorsum.

The transverse section of the lorica is greatly compressed, straight dorsally and widely angular ventrally.

Length of lorica, 130 $\mu$ . Width of lorica at widest part, 85 $\mu$ ; anterior margin, 78 $\mu$ .

*Testudinella dicella* was fairly common and well distributed on the island. It has also been collected in abundance in the Pocono Mountains, Pennsylvania, Vilas County, Wisconsin, and Atlantic County, New Jersey.

Although this species seems to be closely related to *Testudinella tridentata* Smirnov, from which it differs principally in the details of the anterior margins and the shape of the lorica, it seems justifiable to name it as a new species, in view of the fact that Smirnov (1) does not show the

location of the lateral antennae nor does he give a transverse section of the lorica, both very important in the determination of species.

The type is deposited in The American Museum of Natural History; Cat. No. A.M.N.H. 261.

### Family **Brachionidae**

#### **Trichotria eukosmeta**, new species

Figures 13, 14

The body is slightly gibbous dorsally. The lorica is minutely punctate and quite flexible. The posterior portion of the dorsum is acuminate from the dorsal view; from the lateral view it terminates in a prominent recurved, bifid projection.

The foot has two joints; the basal joint is stout and conical and bears two long acute condyles on its dorsal surface. The toes are blade-shaped, slightly decurved and parallel-sided; they are about equal to the foot in length.

The lateral antennae are guarded by a prominent hook-like spine. The dorsal antenna is a prominent papillose projection from which emerges a tuft of sensory setae.

The mastax is malleate and the anatomy agrees with that of the other members of the genus.

Total length, 220 $\mu$ ; toes 30 $\mu$ .

A few specimens of *Trichotria eukosmeta* were collected in Fawn Pond during the summer of 1926. It has not been found again.

Although the other members of the genus *Trichotria* are notable for the thickness of the lorica, which is always marked by facets, the integument of this species is thin and flexible without any traces of faceting. *Trichotria tetractis caudata* (Lucks) has a posterior pointed projection of the lorica, but it is never bifid from the lateral view. Moreover, that variety has a normal faceted lorica and closely resembles *Trichotria tetractis* (Ehrenberg).

The type is deposited in The American Museum of Natural History; Cat. No. A. M. N. H. 653.

### GENERAL REMARKS ON DISTRIBUTION OF ROTIFERS

Although it is true that there seem to be a number of species that are indigenous to the separate localities, the rotatorian faunas of Mount Desert Island, Vilas County, Wisconsin, and Atlantic County, New Jersey are strikingly similar. The various bodies of water included in the three localities range in pH from 3.5 to 6.8 in the littoral regions. Therefore, the fauna is an acid water fauna and most of the species of such typical alkaline genera as *Brachionus*, *Mytilina*, *Eosphora*, *Notholca*, *Asplanchna*, *Lacinularia* and *Sinantherina* are practically absent; at least they are only represented by occasional stragglers.

## METHODS OF COLLECTION AND STUDY

In describing new species preference has been given to those whose habitats are also Wisconsin and New Jersey. There remain a number of provisional species that may be indigenous and new. These have been left in abeyance until such time as more is learned about them by future research.

In view of the fact that such a large number of species were recorded from an island of only one hundred and five square miles in area, a note on the method of collecting will not be amiss.

It was decided, in order to be as accurate as possible in the determination of species and the description of new ones, to examine all material in the living state. Therefore it was necessary to transport the specimens collected to the laboratory as quickly as possible, instead of narcotizing and fixing the material in the field, as is frequently done.

Aquatic plants were gently lifted above the surface and placed in wide-mouthed jars of 1000 cc. capacity, containing water from the same source, care being taken not to crowd too much. This trapped the rotifers among the leaves while washing off most of the undesirable organisms, such as Entomostraca, insect larvae, and aquatic worms. In such collections the change in environment is not too sudden, but takes place gradually, while the food and safety factors are maintained better than in clear collections which have been concentrated by means of a net of fine mesh. The net was only resorted to occasionally in the absence of aquatics. Thousands of organisms are introduced into the containers with the plants. Animal death and post-mortem changes begin to take place at once. Therefore, in order to work over the collections while they were as fresh as possible, and in view of the fact that virtually all of the locations were bounded by good roads, an automobile was in constant use 'or transporting the collections to the laboratory. On arrival, the containers were placed several feet from the source of light. The heavier vitiated water gradually sank to the bottom and the lighter purer water rose to the top. After a certain interval, depending on the temperature, the rotifers came out from among the plants and ascended with the fresher water; they eventually reached the surface and assembled on the side nearest the light and crowded into the meniscus, from which they were removed and transferred to watch glasses. Virtually 90 per cent of all the rotifers listed were collected in the above manner.

Material of the species described in Parts VI and VII have been placed in the collection of The American Museum of Natural History.

All investigations and research work on the Rotifers of Mount



Desert Island were carried on at the Wier Mitchell Station of the Mount Desert Island Biological Laboratory, situated at Salisbury Cove, Maine. The author wishes to express his appreciation and thanks for the many courtesies enjoyed and pleasant associations formed there during the summers of 1921 to 1931 inclusive.

#### BIBLIOGRAPHY

- (1) SMIRNOV, N. 1931. 'Deux nouvelles espèces de Rotatoriens, provenant de la région de l'Oussouri.' *Comptes Rendus de l'Acad. Sci. de l'Urss.*, pp. 54-58, Text Figure.

59.82 (83)

DESCRIPTIONS OF NEW BIRDS FROM MOCHA ISLAND,  
CHILE, AND THE FALKLAND ISLANDS, WITH COM-  
MENTS ON THEIR BIRD LIFE AND THAT OF  
THE JUAN FERNANDEZ ISLANDS AND  
CHIOLE ISLAND, CHILE

BY FRANK M. CHAPMAN

## MOCHA ISLAND

Mocha Island lies on the continental shelf about twenty-two miles off the coast of central Chile between approximately 38° 11' and 38° 24' South latitude. Since my first visit to Chile, in 1916, I have planned to visit Mocha Island, but it was not until 1932 that the Museum succeeded in sending a representative to that island. In November of that year Mr. D. S. Bullock of Angol, Chile, so well known for his natural history work in that country, visited the island in our behalf. He remained five weeks and secured a collection of 125 birds and 42 mammals. The former have been presented to the American Museum by Dr. L. C. Sanford. Meanwhile, R. P. Rafael Housse, as a result of his exploration in 1924, had published<sup>1</sup> an annotated list of 59 species of birds observed on Mocha, to which he added notes on 16 additional species reported to him the following year by R. P. Juan Enrique Gajardo.<sup>2</sup>

The fully annotated report supplied by Mr. Bullock contains notes on 70 species, of which 11 are not contained in Father Housse's report. The known avifauna of Mocha, therefore, is well over 80 species and is essentially that of the mainland and its coastal islets. Mr. Bullock, however, calls attention to the absence of *Pezites militaris militaris*, *Mimus thenca*, and the three Chilean woodpeckers, though conditions are suitable for their existence on the island.

The area of Mocha is approximately 12,500 acres, of which about one half, Mr. Bullock writes, is mountainous and covered with forests. The general characteristics and history of the island are described in a series of papers in the *Anales Museo Nacional de Chile*, No. 16, 1903.

I speak here only of the birds that Mr. Bullock's collections show are peculiar to the island. None of them appears to have been described

<sup>1</sup>1924, *Revista Chilena de Historia Natural*, XXVIII, pp. 47-54.<sup>2</sup>Idem, 1925, XXIX, pp. 225-227.

before. Although their differences from the mainland forms are slight, the fact that they exist and are sufficiently pronounced and constant to warrant recognition, bespeaks for Mocha Island a prolonged separation from the mainland.

In this connection I have been interested in learning of the peculiar land bird life of the other islands off the coast of southern South America, and I give beyond, briefly, the results of my studies.

I am indebted to the Field Museum for the loan of 35 specimens of Chilean birds which have been of much value in the preparation of this paper.

***Aphrastura spinicauda bullocki*, new subspecies**

**SUBSPECIFIC CHARACTERS.**—Intermediate between *Aphrastura spinicauda spinicauda* (Gmelin) of the Chilean mainland and *A. s. fulva* Angelini of Chiloe Island; the throat and upper breast white, the remainder of the under parts warm buff deepening to ochraceous buff posteriorly; apparently averaging slightly larger.

**TYPE.**—No. 387,391, Amer. Mus. Nat. Hist.; ♂; Mocha Island, Chile; November 11, 1932; D. S. Bullock.

**Measurements**

		SEX	WING	TAIL	CULMEN
Mocha Isl.,	Chile	♂	65	79	14.9
Ancud, Chiloe,	"	♂	62	73	14
Corral,	"	♂	61	73	14.5
"	"	♂	61	77	14.2
Angol,	"	♂	60	75	15
Temuco,	"	♂	60	78	14.1
Puerto Montt,	"	♂	58	73	14.2
Mocha Isl.,	"	♀	61	70.5	15.2
Corral,	"	♀	57	72	13.5
"	"	♀	58	70	13.2
Temuco,	"	♀	57	69	13.3
Punta Arenas,	"	♀	59	72	13.2
False Cape Horn,	"	♀	57	70	13.9

**SPECIMENS EXAMINED**

*Aphrastura spinicauda bullocki*.—Mocha Island, 1 ♂, 1 ♀.

*Aphrastura spinicauda spinicauda*.—Angol, 5; Temuco, 2; Corral, 9; Puerto Montt, 1; Pumalin, 1; Guaitecas, 1; Ultima Esperanza, 3; Punta Arenas, 1; London Isl., 2; O'Brien Isl., 3; Smoke Isl., 1; False Cape Horn, 4; Cape Horn, 1.

*Aphrastura spinicauda fulva*.—Chiloe Isl., 2.

*Aphrastura masafuerae*.—Masafuera Isl., 1.

It is noteworthy that *Aphrastura spinicauda* should range from central Chile to Cape Horn without exhibiting appreciable racial variation except on Chiloe and Mocha islands, where the characters of the

insular forms differ only in degree. Our single female of *bullocki*, as with our one female of *fulva*, is less richly colored below than the male.

With much pleasure I name this form for its collector, Mr. D. S. Bullock, of Angol, Chile, as a slight recognition of the service he has rendered ornithology in Chile.

***Scelorchilus rubecola mochae*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Scelorchilus rubecola rubecola* (Kittlitz) in color but larger.

TYPE.—No. 387,370, Amer. Mus. Nat. Hist.; ♂ ad.; Mocha Island, Chile; November 11, 1932; D. S. Bullock.

Measurements of Specimens Examined

		SEX	WING	TAIL	TARSUS	CULMEN
Mocha Isl.,	Chile	♂	78	65	40	20
" "	"	♂	77	70	39.5	21
" "	"	♂	77	66	40.5	....
Temuco,	"	♂	75	61	....	20
Corral,	"	♂	74	61	37	20
Ancud,	"	♂	71	63	33	19
" "	"	♂	72	63	38	19
Quicavi, Chiloe,	"	♂	70	59	38	20
Rio Ino, Chiloe,	"	♂	74	62	37	19.5
" " "	"	♂	68	59	36	18
Mocha Isl.,	"	♀	78	67	40	20
" "	"	♀	75	56	37	20
Corral,	"	♀	71	61	37	19.5
" "	"	♀	72	59	35	18.5
Puerto Montt,	"	♀	67	57	37	19
Ancud,	"	♀	71	63	37	....
" "	"	♀	70	58	35	18
Quellon, Chiloe,	"	♀	70	56	36	18
" " "	"	♀	69	55	37	18
Rio Aysen,	"	♀	72	62	37	19

The tendency of island forms to exhibit larger size is well illustrated by this race. In general dimensions, as well as in the size of most of its parts, it is constantly larger than the mainland bird.

***Turdus falcklandii mochae*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar in color to *Turdus falcklandii magellanicus* King, but with a consistently larger bill; resembling *Turdus falcklandii falcklandii* Quoy and Gaimard, but bill averaging slightly smaller, coloration generally paler, the under parts particularly grayer, the lower throat less suffused by the color of the breast.

TYPE.—No. 387, 422, Amer. Mus. Nat. Hist.; ♂ ad.; Mocha Island, Chile; December 5, 1932; D. S. Bullock.

### Measurements of Males

			WING	TAIL	CULMEN
Mocha Isl.,	Chile	Nov. 24, 1932	134	96	29
" "	"	" 25, 1932	133	103	28
" "	"	Dec. 5, 1932	136	108	28
Corral,	"	Sept. 25, 1913	133	98	24
Temuco,	"	June 24, 1910	133	100	24.5
Ancud,	"	" 23, 1914	129	96	25.5
Punta Arenas,	"	Mar. 12, 1915	132	96	24
" "	"	Dec. 12, 1897	134	100	24
False Cape Horn,	"	" 23, 1914	133	99	25
" " "	"	" 23, 1914	128	98	25
" " "	"	" 31, 1914	132	97	25
Masatierra Isl.,	"	Jan. 9, 1914	132	102	26
" "	"	" 9, 1914	134	102	26
" "	"	" 16, 1914	138	106	25
" "	"	Dec. 27, 1913	135	105	25
" "	"	" 27, 1913	133	99	25
Falkland Isl.,	"	Oct. 15, 1915	144	105	30
" "	"	" 15, 1915	142	105	30
" "	"	" 29, 1915	135	96	29.5

### SPECIMENS EXAMINED

*Turdus falcklandii mochae*.—Mocha Isl., 3 ♂.

*Turdus falcklandii magellanicus*.—Temuco, 1 ♂; Corral, 1 ♂; Corral, 1 ♂; Ancud, 1 ♂; Masatierra Isl., 14 ♂, 13 ♀; Punta Arenas, 1 ♂, 2 ♀; Londonderry Isl., 1 ♂; False Cape Horn, 3 ♂; Cape Horn, 1 ♂.

*Turdus falcklandii falcklandii*.—Falkland Isl., 3 ♂, 4 ♀.

The seasonal variation in this species to which Hellmayr<sup>1</sup> has called attention is well illustrated by our excellent series. Our three specimens from Mocha Island are in slightly worn breeding plumage and have the breast somewhat grayer than in comparable mainland birds, but this is possibly attributable to wear.

It is noteworthy that, although the forms of the Falkland Islands and Mocha Island have larger bills than the mainland bird, this character is not exhibited by our representative series from Masatierra Island which is not separable from the mainland form.

### JUAN FERNANDEZ ISLANDS

This group is composed of two main islands, Masatierra and Masafuera, situated respectively 365 and 465 miles off the coast of central

<sup>1</sup>1932, 'Birds of Chile,' p. 28.

Chile. They are separated from the mainland by depths of from 3000 to 4000 meters and are oceanic islands of volcanic origin. They have no indigenous mammalia and their limited land bird life has evidently been fortuitously acquired. It numbers, aside from accidental and introduced species, eight species and one subspecies, seven of which occur on Masatierra and five on Masafuera. Of this number six are peculiar to the islands, Masatierra having five, of which two are unknown on Masafuera, and the latter island four, of which one is unknown on Masatierra.

*Turdus falcklandii magellanicus* is common on both Masatierra and Masafuera, and *Sephanoides sephanoides* (Lesson and Garnot)<sup>1</sup> is common on Masatierra. The fact that neither of these species shows any appreciable variation from the mainland form indicates their recent establishment in the islands. The introduced species are *Lophortyx californica* and *Columba livia*.<sup>2</sup>

***Buteo erythronotus exsul* Salvin**

Masafuera; Masatierra.

A representative of *Buteo erythronotus* of the mainland. L. Bäckstrom, the zoölogist of the Skottsberg Expedition, is quoted by Lönnberg as writing: "Over Masatierra I only saw a few buzzards, which seldom remain more than a couple of days and then return to Masafuera."

***Cerchneis sparveria fernandensis* Chapman**

Masatierra.

A well-marked form of *C. s. cinnamomina* (Swainson) of Chile.

***Thaumaste fernandensis fernandensis* (King)**

Masatierra.

A distinct species of unknown origin. It is represented on Masafuera by the following:

***Thaumaste fernandensis leyboldi* (Gould)**

Masafuera.

A representative of *T. f. fernandensis*, to which it is closely related.

***Cinclodes oustaleti basckstroemii* Lönnberg**

Masafuera and Masatierra.

A close ally of *Cinclodes oustaleti oustaleti* Scott of Chile. It appears to be common on Masafuera but is known from only one specimen from Masatierra.

<sup>1</sup>*Eustephanus galeritus* auct.

<sup>2</sup>See a paper on 'The Birds of the Juan Fernandez Islands,' by Einar Lönnberg, 1921, in 'The Natural History of Juan Fernandez and Easter Island,' Upsala, III, pp. 1-24.

***Aphrastura masafueræ* (Philippi and Landbeck)**

Masafuera.

Apparently a specifically distinct representative of *A. spinicauda* of Chile. Its relationships are commented on elsewhere.

***Spizitornis fernandezianus* (Philippi)**

Masatierra.

Doubtless a representative of *Spizitornis parulus parulus* (Kittlitz) of the Chilean mainland. Like that species it has the back unstreaked, but in its heavily streaked throat and breast it more nearly resembles *S. reguloides albiventris* Chapman of the central Peruvian coast.

**CHILOE ISLAND**

The Pacific coast of Chile, from Chiloe Island to Cape Horn, a distance of approximately 1000 miles, is a mosaic of islands. Formed by subsidence, they are obviously a part of the continent from which, and from one another, they are not widely enough separated to afford true insular isolation. Only one of these innumerable islands is known to possess a bird restricted to it. This is Chiloe Island which, at its northern end, is separated from the mainland by a channel less than two miles in width. The bird is *Aphrastura spinicauda fulva* Angelini.

The avifauna of Chiloe Island is so nearly identical with that of the mainland that it is surprising to find in it this distinct, insular race of *Aphrastura spinicauda*. Moreover, it is the only bird restricted to it. However, *Aphrastura spinicauda* is evidently a variable form, and in spite of the fact that it ranges from central Chile to Cape Horn without exhibiting appreciable variation it has developed, as we have seen, insular forms on Masafuera, Mocha, and Chiloe islands.

**FALKLAND ISLANDS**

The Falkland Islands lie within the 100-fathom line on an extension of the continental shelf about 260 miles east of the entrance to the Straits of Magellan. Their continental affinity is indicated by their position as well as by their birds. Of the latter, according to A. G. Bennett,<sup>1</sup> about 107 species have been recorded from the Falklands. Of this number 24 may be classed as land birds. They include the turkey buzzard (*Cathartes aura jota*); 7 Falconidae, of which one is restricted to the Falklands; 2 owls, one a Falkland race; and 9 resident passerine

<sup>1</sup>1926, *Ibis*, pp. 306-333.

birds of which 6, possibly 7, are Falkland forms. Comments follow on the indigenous birds.

***Ibycter australis* (Gmelin)**

A distinct species finding its nearest, but distant, relative in *Ibycter carunculatus* of the Paramo Zone in Ecuador and Colombia.

***Asio flammeus sanfordi* Bangs**

A slightly differentiated form of the continental short-eared owl.

***Cinclodes antarcticus antarcticus* (Garnot)**

Represented in the Cape Horn region by *C. a. maculirostris* Dabbene, a well-marked race.

***Cistothorus platensis falklandicus*, new subspecies**

**SUBSPECIFIC CHARACTERS.**—Similar to *Cistothorus platensis hornensis* (Lesson) but bill heavier, the plumage with less black; prevailing color of the upper parts of the somewhat worn and faded breeding plumage light buff to warm buff, instead of black as in *hornensis*.

**TYPE.**—No. 165,401, Amer. Mus. Nat. Hist.; ♂ ad.; "testes large, breeding"; Sea Lion Island, Falkland Isl.; December 15, 1915; R. H. Beck.

**Measurements**

	SEX	WING	TAIL	CULMEN	DEPTH OF BILL
					AT BASE OF NOSTRIL
Sea Lion Isl., Falkland Isl.	♂	49	39	14.2	3.4
" " " " "	♂	51	41	13	3.2
" " " " "	♀	50.5	39	13.1	3.4
West Point Isl., " "	♂	49	41	14	3.3
Rio Chico, Patagonia	♂	47	39	13.2	2.5
Tierra del Fuego, Argentina	?	48	38	12.5	3.0
Rio Nireguao, Chile	♀	47	38	14.2	2.9
Mocha Isl., " "	♂	46	38	14	2.7
" " " " "	♀	44	39	14	2.9

**SPECIMENS EXAMINED**

*Cistothorus platensis falklandicus*.—FALKLAND ISLANDS: Sea Lion Isl., 2 ♂ ad., 1 ♀ ad.; West Point Isl., 1 ♂ ad., 1 ♂ im.

*Cistothorus platensis hornensis*.—TIERRA DEL FUEGO, 1 ad., July 3. RIO CHICO, Pat., 2 ♂ ad., March 15; Cheeput, Pat., 1 ♂ ad., Sept. 16. CHILE: Rio Inio, Chiloe Isl., 2 im. ♂, Jan. 3, 27, 1 im. ♀, Jan. 11.; Portales, Cautin, 1 ♂ im., Feb. 9; Rio Nireguao, 1 ♂ ad., March 1, 1 ♀ ad., March 1; Nige Tolten, Cautin, 2 ♂ ad., Dec. 25, 27; Mocha Island, 2 ♂ ad., 1 ♀ ad., Nov. 12, 25, 1 ♂ im., Nov. 21, Dec. 5.

In determining the identity of the seven specimens of *Cistothorus platensis*, which Mr. Bullock sent us from Mocha Island with *C. p.*



*hornensis*, it was discovered that five specimens of this species collected by R. H. Beck on the Falkland Islands in December, 1916, and January, 1917, represent a strongly marked and apparently undescribed race.

Two males and a female taken on Sea Lion Island, December 17, are in somewhat worn breeding plumage and are exactly comparable with three specimens taken on Mocha Island, November 12, 1932. Their differences are stated in the preceding diagnosis.

A fourth Falkland Island specimen taken on West Point Island, January 31, is an adult male in unworn postnuptial plumage. It resembles the least worn of the Sea Lion Island specimens, but the outer margins of the wings are wider and buffier, the tail browner. From a specimen of *hornensis* in similar plumage (Rio Nireguao, Chile, March 1, 1923; Field Mus., No. 61849) it differs in having the black areas smaller, the buff or browner areas larger and paler, the bill heavier.

A fifth Falkland Island specimen, taken on the same date and place as the last, is a young bird in postjuvinal plumage. It differs from numerous specimens of *hornensis* in corresponding plumage in having smaller black areas, the brownish markings being of essentially the same color. The bill is not yet fully grown. Without our remaining Falkland Island specimens I should refer this immature bird to *hornensis*. Its undeveloped bill does not show the most impressive character of the Falkland Island race, and its colors are nearer those of *hornensis* than they are to those of adult *falklandicus*.

#### ***Troglodytes cobbi* Chubb**

A specifically distinct representative of the continental *Troglodytes musculus*.

#### ***Turdus falklandii falklandii* (Quoy and Gaimard)**

A closely allied race of the Patagonian and Chilean forms.

#### ***Anthus correndera phillipsi* Brooks**

A representative of *A. c. correndera* Vieillot of southern South America.

#### ***Phrygilus malvinarum* Brooks**

Based on a single, unsexed immature specimen, the standing and relationships of this form are unknown.

#### ***Pezites militaris falklandicus* (Leverkuhn)**

A closely allied representative of *P. m. militaris* (Linnaeus) of Chile and Patagonia.

59, 43, 8 (935)

STUDIES ON *PAPUINA* AND *DENDROTROCHUS*,  
PULMONATE MOLLUSKS FROM THE  
SOLOMON ISLANDS

BY ILSE RENSCH

Through the good offices of Dr. E. Mayr and Mr. W. J. Eyerdam, Dr. Roy W. Miner, Curator of Living Invertebrates, of The American Museum of Natural History, New York, sent me for examination the papuinas that were gathered on the Solomon Islands by the Whitney South Sea Expedition. I have taken great pleasure and interest in studying this collection, and I take this opportunity to express my thanks to the above-mentioned gentlemen.

Altogether twenty species of *Papuina* were gathered, some of them in large series. One of these species is represented by a new race, and two species are new. I take the liberty of naming these new species after the collectors. Eighteen species have been previously recorded.

By mistake the species of *Dendrotrochus* gathered during the South Sea Expedition were also sent to Berlin. I have examined these shells because I have just received a considerable series of *Dendrotrochus* from the Museum of Basel, collected by Dr. Hediger, Dr. Bühler, and Dr. E. Paravicini.<sup>1</sup>

Both of these collections gave me an opportunity to clear up the whole "Rassenkreis" of *Dendrotrochus helicinioides*. This Rassenkreis represents a prototype. Six forms, which were looked upon hitherto as species, are now grouped together in a Rassenkreis because they have similar characters and replace one another geographically. Each race differs distinctly from the neighboring races but shows also considerable individual variation, often contrasting with the neighboring races. It is of great significance that there are also anatomical differences between the races. The genital systems do not differ, but the radulae show two different types. It is most interesting that even when the shells are rather similar, the radulae are quite different in some cases. For such a complex of related forms the expression "species" is insufficient, the single geographical variants being distinguished like species in the former

<sup>1</sup>New species established in this paper: *Papuina eyerdami*, *P. mayri*. New races: *P. plagiostoma bougainvilliana*, *Dendrotrochus helicinioides intercalata*.

sense of the word. In order to characterize the degree of phylogenetic development, the studied forms of *Dendrotrachus* would be better called a "Rassenkreis." (See B. Rensch, 1929, 'Das Prinzip geographischer Rassenkreise und das Problem der Artbildung,' Berlin.)

***Papuina gamelia* (Angas)**

Figure 1

*Geotrochus gamelia* ANGAS, 1867, Proc. Zool. Soc. London, p. 888, Pl. XLIII, figs. 1-3.

*Geotrochus hargreavesi* ANGAS, 1869, idem, p. 625, Pl. XLVIII, fig. 2.

TYPE LOCALITY.—St. Stephen Island and Ysabel Island, Solomon Islands.

MATERIAL.—Large series from Choiseul Island (Luti, Bambatina, Lumbée, Choiseul Bay, Poro-Poro, Wurulata River). One specimen from Bougainville (Buin).

In the description of *Papuina gamelia*, Angas mentions a variety having a very broad band below, which is quite different from the small band of the typical form. The columella and the lip are colored brown instead of white. On the last three whorls there is also a small band at a distance of 1 mm. from the suture. The typical *gamelia* has this band very near the suture, so that it touches the peripheral band of the anterior whorl.

Angas, in 1869, described *Papuina hargreavesi*. This species has a similar form, the broad band below and the dark lip like the variety of *P. gamelia*, but the upper band touches the suture as does that of the typical *gamelia*. The series collected by the Whitney South Sea Expedition shows the same character. Smith<sup>1</sup> mentioned the great similarity of the two species. The only differences from *P. gamelia* that Smith recognizes are untenable in view of the description of the variety of *P. gamelia*. Besides, Smith emphasizes the fact that the last whorl of *P. gamelia* is not descending and the last whorl of *P. hargreavesi* is distinctly descending. But Angas writes in the description of *P. gamelia*: "the last more or less descending." The specimens of both "species" before me show the same condition.

All these attributes cause me to consider *Papuina hargreavesi* as a synonym of *P. gamelia*. Only a very large series with exact localities can show whether there is only one variety on each island or at least a large percentage of one variety. In that case it would be necessary to treat them as geographical races.

<sup>1</sup>1885, Proc. Zool. Soc. London, p. 591.

This surmise is founded on the large series of about 170 shells that the Whitney South Sea Expedition collected on Choiseul. All specimens possess (1) the clearer brown color of the bands (the typical *P. gamelia* has nearly black bands), (2) the band on the whorl distant 1 mm. from the suture (as in the variety of *P. gamelia*), (3) the band below never small (as in the typical *P. gamelia*), but always expanded as far as the umbilicus, being evenly brown or weakly brown-colored (as in the typical *P. hargreavesi*). The descending of the last whorl and the

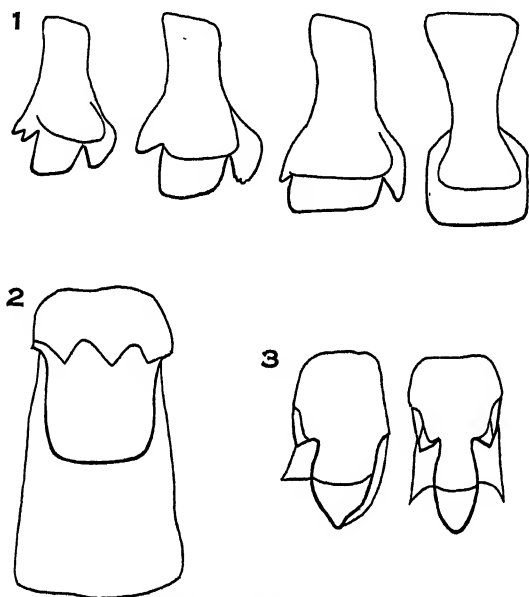


Fig. 1. Radula teeth of *Papuina gamelia* (Angas).

Fig. 2. Central tooth of the radula of *Papuina motacilla* (Pfeiffer).

Fig. 3. Radula teeth (central tooth and second tooth) of *Dendrotrochus h. helicinooides* (Hombron and Jacquinot) from Guadalcanar.

color of the lip are variable. It is remarkable that nearly all well-preserved specimens have distinct rectangular blotches near the ends of the bands which are more deeply colored and more diaphanous.

Altitude, 16.4–22.2 mm., average, 19 mm.; diameter, 18.2–23.7 mm., average 21.2 mm.

The radula (Fig. 1) shows the normal *Papuina* type of V-shaped teeth rows. Next to the central tooth, which is formed like a spatula, there follow in the middle part of the radula fifty-five teeth on each side.

These have a broad mesoconus and an entoconus. The ectoconus is generally first visible on the fourth, or even not until the eighth or tenth tooth, and then rapidly increases in size, and toward the margins it becomes double [see *P. ambrosia* (Angas)].

The reproductive organs examined in a specimen from Bougainville [collected by Hediger (Basel)], lack every accessory organ. The bursa of the receptaculum seminis is conglobate.

One specimen, collected on Bougainville, corresponds to the typical *P. gamelia*, but it differs from the large series from Choiseul. The characters of *P. gamelia* are also shown by six shells collected by Hediger (Basel), two shells from the collection of Kaltenbach (Gernrode), three shells from the Museum of Berlin, and two shells from the Museum of Leiden, all collected on Bougainville, and four on Shortland Island. It is possible that the typical *P. gamelia* is generally to be found only on Bougainville and Shortland Islands.

In 1869, Angas described *Helix* (*Geotrochus*) *dampieri* from the Louisiade Islands (Proc. Zool. Soc. London, II, p. 47, Fig. 6). His figure of this species corresponds quite closely to the above-mentioned *Papuina gamelia* Angas. It is possible that there are relationships between the two forms, inasmuch as Smith, 1885, designated shells from Choiseul Island as "*P. dampieri* Ang. var.—" If this identification is correct, *Papuina dampieri smithi* C. R. Boettger from Gower Island, according to my opinion, should be regarded as a distinct species.

### ***Papuina ambrosia* (Angas)**

*Geotrochus ambrosia* ANGAS, 1867, Proc. Zool. Soc. London, p. 889, Pl. XLIII, figs. 9-10.

*Helix ramsdeni* ANGAS, 1876, idem, p. 266, Pl. XXVI, figs. 6-7.

TYPE LOCALITY.—Galera or Russel Island, Solomon Islands.

MATERIAL.—Thirty-eight adult and three immature specimens, Florida Island, north of Guadalcanar; five specimens, Tulagi island, one-half mile from Florida Island; two adult and one immature specimens, Olevuga Island; one specimen, Choiseul Island.

Typical of *P. ambrosia* are bluish-white patches of various sizes, as in *Cochlostyla*. All specimens collected by the Whitney South Sea Expedition from three localities have this character. Shells of the series from Florida Island most resemble, in form and dimensions, *Papuina ramsdeni* Angas, which is considered a synonym of *Papuina ambrosia*. But *P. ramsdeni* is slenderer and has a greater altitude and generally one whorl more. Two shells from the collection of the Museum of Leiden,

also from Florida Island, show the same. On Olevuga, a small island northwest of Florida, there lives the typical *P. ambrosia*, which has the apex more obtuse and the whorls more vaulted. Five shells from Tulagi, a small island one-half mile from Florida, have the form of the typical *P. ambrosia* but not the same design. All these five shells have a brown band about 3 or 4 mm. broad above the periphery. On the penultimate whorl it becomes paler and then it disappears. Immediately below the suture there is also a small band (nearly 1 mm.), and another on the base. Typical specimens of *P. ambrosia* show only a broad band of 5 to 6 mm. on the last whorl. Two small series from the collection of the Museum at Berlin, from Russell Island (type locality of *P. ambrosia*), have the typical form and design of *P. ambrosia*, and the same is true for two specimens collected by Paravicini (Basel) on Guadalcanar (Domma, Savu).

*P. ramsdeni*, as just mentioned, is recognized as a synonym of *P. ambrosia*. It is possible, however, that the specimens of *P. ramsdeni* and also the specimens of *P. ambrosia* are limited geographically, because one series of thirty-eight shells from Florida Island shows the principal characters of *P. ramsdeni* (the large form), and the other series (thirty-three shells, but without locality) represents especially the typical *P. ambrosia*.

CONCLUSIONS.—Typical *P. ambrosia* is to be found principally on Russell, Olebuga, Tulagi, Guadalcanar Islands (New Georgia, see Clapp<sup>1</sup>); the typical *P. ramsdeni* on Florida Island, one specimen on Choiseul. It is therefore possible that the two forms are geographical races.

Altitude, 19.4–23.9 average, 21.1 mm.; diameter, 19.1–23.3, average, 20.6 mm. (*ambrosia* form). Altitude, 20.8–25.8, average, 24.9 mm.; diameter, 18.8–24.2, average, 21.9 mm. (*ramsdeni* form). The average altitude of the two forms differs by 3 mm.

The radula and the reproductive organs could be studied in one shell in alcohol, collected by Dr. E. Paravicini. The radula has the same form and the same number of teeth as *P. gamelia* (Angas). The first to fourth teeth have not a trace of an ectoconus, and I believe also that the occurrence of the ectoconus is most variable, for in only one of four radulae of *P. gamelia* studied, the first tooth after the central tooth has an ectoconus.

The reproductive organs generally resemble the figure of the genital system of *P. grata* (Michaux), copied in the 'Manual of Conchology' of Tryon and Pilsbry, IX, Pl. XII, fig. 16. There are no accessory organs.

<sup>1</sup>1923, Bull. Mus. Comp. Zool., Harvard, LXV, p. 386.

***Papuina malantensis* (Angas)**

*Helix malantensis* ANGAS, 1876, Proc. Zool. Soc. London, p. 488, Pl. XLVII, figs. 1-3.

TYPE LOCALITY.—Malanta Island (Malaita), Solomon Islands.

MATERIAL.—One specimen, San Cristobal (Makira), Solomon Islands.

*Papuina malantensis*, described from Malaita, was collected on San Cristobal for the first time by the Whitney South Sea Expedition. Tryon and Pilsbry<sup>1</sup> mention the near relationship to *P. ambrosia* (Angas). But after having compared it with a large series of *P. guadalcanarensis* (Cox), collected by Dr. E. Paravicini of Basel, I believe that *P. malantensis* is still more closely related to the latter species. As I have no topotypical material from Malaita, I can compare the mentioned specimen from San Cristobal only with *P. guadalcanarensis* and *P. ambrosia*. *P. malantensis* has no patches and a greater number of bands. Because of its small form it resembles the specimens of *P. ambrosia* variety *ramsdeni*. The lip is only a little more expanded than that of *P. ambrosia*, but not so much expanded as that of *P. guadalcanarensis*. *P. malantensis* has the same small size and form, and especially as great a number of bands, as *P. guadalcanarensis*, but the latter is generally distinguished by the dark brown streak behind the expansion of the white lip and by the angled periphery.

Altitude, 25.7 mm.; diameter, 21.6 mm.

It is possible that *P. guadalcanarensis* is the geographical representative of *P. malantensis*. But *P. ambrosia* cannot be another geographical race, because Paravicini found *P. ambrosia* also at two localities on Guadalcanar.

***Papuina brodiei* (Brazier)**

*Helix brodiei* BRAZIER, 1872, Proc. Zool. Soc. London, p. 20, Pl. IV, fig. 6.

TYPE LOCALITY.—Choiseul Island, Solomon Islands.

MATERIAL.—Seven adult specimens, one juvenal specimen, Choiseul Island (headlands of Wurulata River, one specimen; Tauro, six specimens).

The specimen from the Wurulata River on Choiseul corresponds to Brazier's figure and description of the variety with small, dark brown bands below and the chalk-white band above.

Altitude, 19.6 mm.; diameter, 23.9 mm.

The dimensions given by Pilsbry (*op. cit.*, p. 11) are much smaller

<sup>1</sup>1891, Manual of Conchology, VII, p. 8.

than those of the specimen before me. Brazier wrote in his description, "Diam. 8 lines, alt. 7 lines." I now believe that Pilsbry has equalized 1 line to  $\frac{1}{2}$  inch. This would be the "old" line. But the "new" line, which was surely employed in 1872, is equal to  $\frac{1}{10}$  inch. If this is correct, the altitude of the typical shell would become 17.5 mm. and the diameter 20 mm., which would better correspond to the dimensions of the shell before me.

Six adult specimens from Tauro, the eastern part of the island, are distinguished from the specimen from the Wurulata River in form and design. The whorls are more vaulted, the last whorl is rounded on the periphery, and the apex is also somewhat blunter. The form and color of the aperture, the number of the whorls (five), the lack of an umbilicus, and the dark brown, hardly expanded lip are the same. The bands show an interesting change. The chalk-white band is well preserved in only one specimen. The brown bands above, as well as those below the chalk-white band, are dissolved into a brown zigzag design, similar, for instance, to the pattern of *P. gaberti* Less. This zigzag design may be as broad as the band of the typical form or it may also cover the whole last whorl.

Altitude, 18.2–19.4 mm.; diameter, 20.2–24.9 mm.

### ***Papuina macfarlanei* (Cox)**

*Helix* (*Geotrochus*) *macfarlanei* Cox, 1873, Proc. Zool. Soc. London, p. 567.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—Two specimens, "Bougainville"; one specimen, Kieta, Bougainville.

*Papuina macfarlanei* (Cox) is related to *P. coriana* (Angas) (see this species). The differences are as follows: *P. macfarlanei* has an almost black violaceous band on the periphery. The hyaline brown blotches change more or less to a zigzag design. The shell has also a different form. The whorls are more vaulted, therefore the last whorl is rounded, whereas *P. coriana* has flatter whorls, so that the last whorl is bluntly carinated.

Altitude, 19.4, 20.8, 21.4 mm.; diameter, 21.8, 24.4, 21.9 mm.

The three specimens from Bougainville and the typical specimen of Cox (altitude 18 mm.; diameter 23 mm.) show relations between the dimensions different than in *P. coriana*. The diameter is always greater than the altitude, but the series of *P. coriana* shows quite the contrary.

Up to the present day this species is known only from Bougainville



and perhaps represents a geographical race of *P. coxiana* found on Ysabel and Choiseul Islands.

***Papuina coxiana* (Angas)**

*Geotrochus coxiana* ANGAS, 1867, Proc. Zool. Soc. London, p. 889, Pl. XLIII, figs. 7, 8.

TYPE LOCALITY.—Ysabel Island, Solomon Islands.

MATERIAL.—Three specimens, Choiseul Island (Luti); fifteen specimens, Choiseul Island (Tauro).

All specimens correspond well with the description of the type.

Altitude, 19.1–23 mm., average, 21.1 mm.; diameter, 17.8–22 mm., average, 20.5 mm.

Up to the present time this species was known only from Ysabel Island. It was first found on Choiseul Island by the Whitney South Sea Expedition. *Papuina macfarlanei* (Cox), which is known from Bougainville (the type locality was not mentioned by Cox) is closely related to *P. coxiana*. The most important and characteristic difference between the two species is the peripheral band of *P. macfarlanei*, which is lacking in *P. coxiana*. More material might make it possible to treat the two "species" as geographical races.

***Papuina xanthochila xanthochila* (Pfeiffer)**

*Helix xanthochila* PFEIFFER, 1861, Proc. Zool. Soc. London, p. 192.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—One specimen, Bougainville Island (Buin), Solomon Islands.

In general, several series before me [thirteen specimens, Bougainville (Malmalomino) collected by Hediger (Basel); fifteen specimens, Bougainville, from the collection of the Museum of Berlin, collected by Sapper; twenty-two specimens, Bougainville, from the collection of Kaltenbach, Gernrode] do not deviate from the description. Most interesting are some specimens with differently colored aperture. In the series of the collection of Kaltenbach there is one shell which has slightly colored margins of the aperture and another one with white margins. The series collected by Sapper on Bougainville consists of seven specimens with orange-colored aperture, two with citrine-colored aperture, and six shells that are intermediately colored. A most important and interesting fact is that the shells with the orange aperture have a relatively smaller diameter of the aperture than the shells with the citrine aperture. In ten shells with orange aperture the diameter of the aperture is 52.7 per cent of the whole altitude, but in the citrine-colored

shells, 55.1 per cent. On the shells with the orange-colored aperture the expansion of the margins is generally smaller than on the citrine colored ones.

Orange-lipped specimens: altitude, 38.1–42.3 mm., average, 39.4 mm.; diameter, 24–29.7 mm., average, 27 mm.; diameter of aperture, 19.5–22 mm., average, 20.8 mm.

Citrine-lipped specimens: altitude, 40.1–47.8 mm., average, 44.5 mm.; diameter, 26.2–32.2 mm., average, 30.2 mm.; diameter of aperture, 21.4–27.4 mm., average, 24.5 mm.

DISTRIBUTION.—Bougainville, Solomon Islands (compare *Papuina xanthochila lilium* Fulton).

#### ***Papuina xanthochila lilium* Fulton**

*Papuina lilium* FULTON, 1905, Jour. of Malacology, XII (2), p. 22, Pl. VI, fig. 4.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—Twenty-four specimens Choiseul Island (Sasamanga River, nineteen; Puti, four; headland of Wurulata River, one).

One of the differences between *Papuina xanthochila* (Pfeiffer) and *P. x. lilium*, according to Fulton's opinion, is the smaller number of whorls ( $5\frac{1}{2}$ ) in *P. x. lilium*. But in the large series before me there are also specimens with 6 and  $6\frac{1}{4}$  whorls. The other differences (large margins of aperture, the relatively larger diameter) are pronounced.

Altitude, 41–45.6 mm.; diameter, 31.6–35.2 mm.

The radula and reproductive organs are not known.

Probably *P. x. lilium* is limited to Choiseul Island. Fulton did not mention the exact locality in his description. But shells from the collection of Fulton, which are now in the collection of the Museum of Berlin, and one shell from the collection of the Museum of Leiden have the locality "Choiseul." Smith also mentions Choiseul Island.<sup>1</sup>

*P. x. xanthochila*, generally resembling *P. x. lilium*, replaces *P. lilium* geographically on Bougainville, in my opinion. But it is not so important whether *P. lilium* is considered a sharply distinguished race of *P. xanthochila*, as I do, or a distinct species, which then must be united with *P. lilium* to an "Artenkreis" (*genus geographicum* in the sense of B. Rensch).

#### ***Papuina splendescens splendescens* (Cox)**

*Helix splendescens* COX, 1865, Proc. Zool. Soc. London, p. 696.

*Helix mendana* ANGAS, 1867, Proc. Zool. Soc. London, p. 889, Pl. XLIII, figs. 11, 12.

*Helix brenchleyi* BRAZIER, 1875, Proc. Linn. Soc. N.S. Wales, I, p. 3.

<sup>1</sup>1905, Ann. Mag. Nat. Hist. London, (7) XVI, p. 196.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—Seven adult specimens, Shortland Island (Faisi).

DISTRIBUTION.—Bougainville, Stephen Island, Shortland Island, Guadalcanar, Ysabel Island (?).

***Papuina splendescens choiseulensis* (Brazier)**

*Helix* (*Geotrochus*) *choiseulensis* BRAZIER, 1869, Proc. Zool. Soc., London, II, p. 47, fig. 6.

MATERIAL.—One hundred specimens, Choiseul Island (Bambatana, seventy-five; Luti, ten; Tauro, eleven; Wurulata River, four; Florida Island (?), one).

Nearly all specimens of *Papuina splendescens* (Cox) that the Whitney South Sea Expedition collected on Choiseul are distinguished from the typical *P. splendescens* by the rose-colored lip and the smaller dimensions. Only those specimens have a white lip that have uncolored (hyaline) bands (of 59 specimens, 14, or 23.7 per cent, are hyaline). The form of the shell, the bands, and the umbilicus are the same. Nineteen shells from Bougainville, two from Stephen Island, two from Shortland Island (in the collection of the Museum of Berlin), seven from Shortland Island (collected by Whitney Expedition) have, in contrast to the rose-lipped form, a white lip and greater altitude. I was not sure that it would be correct to treat the specimens from Choiseul as a new geographical race, because *P. mendana* (Angas) from Ysabel Island and *P. brencleyi* (Angas) from Guadalcanar, synonyms of *P. splendescens*, also have a white lip. The rose-lipped race would therefore be surrounded geographically by the white-lipped race. But the fact is important that Smith (1885, Proc. Zool. Soc. London, p. 591) wrote that Angas himself presented to the British Museum (Natural History) specimens of *P. mendana* from Bougainville, so that perhaps the locality "Ysabel Island" may be an error of Angas. And at least Guadalcanar must be regarded as a locality for specimens with a white lip. I believe it probable that on Choiseul Island there arose a dominant mutation with a rose lip and that it suppressed the normal variety on this island.

In studying the mollusk papers on the Solomon Islands, I have found a name that must be employed for this form: *Helix* (*Geotrochus*) *choiseulensis* Brazier. Brazier gave a colored figure, which corresponds well with the specimens before me, and he even noted that "this pretty species is intermediate in form between *Helix splendescens* Cox and *Helix mendana* Angas from the Solomon Islands."

Interesting and remarkable is the variability of the bands of both

racés. The typical specimens have, besides the yellowish to chalk-white ground color (violaceous brown toward the apex), two chestnut bands which are about 2 mm. broad. The color of the bands may also be darker or lighter. Most specimens of the Tauro series have the peripheral band considerably darker than the basal and the upper bands. Cox mentions the same for the typical race. Besides, in this species the upper and the basal bands are generally so widened that only a small chalk-white band remains below the suture and below (and sometimes also above) the peripheral band. One specimen from Choiseul shows the bands covering the whole shell except a small white line near the suture.

White-lipped specimens (12) have an altitude of 26.8–30 mm., average, 28.4 mm.; a diameter of 23.7–25.5 mm., average, 24.1 mm.; rose-lipped specimens have an altitude of 21.1–30 mm., average, 24.7 mm.; and a diameter of 18.5–26 mm., average, 21.6 mm.

The radula and the genital system are not known.

#### *Papuina meta* (Pfeiffer)

*Helix meta* PFEIFFER, 1856, Proc. Zool. Soc. London, p. 381, Pl. xxvi, fig. 5.

*Helix acmella* PFEIFFER, 1860, idem, p. 135, Pl. I, fig. 4.

*Helix deidamia* ANGAS, 1869, idem, p. 625, Pl. XLVIII, fig. 3.

*Helix miser* COX, 1873, idem, p. 146.

*Helix beatrix* ANGAS, 1876, idem, p. 265, Pl. xx, figs. 1–5.

TYPE LOCALITY.—(Erroneously, Admiralty Islands) Solomon Islands.

MATERIAL.—Thirteen adult specimens, Choiseul Island; eight adult specimens, Florida Island; four specimens, Bougainville (Buin, two adults; Kieta, two juvenals).

The material before me shows that *Papuina meta* (Pfeiffer), *P. meta* variety *acmella* (Pfeiffer), and *P. miser* (Cox) [= *P. beatrix* (Angas)] are synonymous. Pilsbry (*op. cit.*, p. 18) also treated *P. acmella* as a synonym of *P. meta*. Though in some shells *P. acmella* differs very strongly from the typical *P. meta*, there are also intermediate specimens among the material before me. The typical *P. acmella* is higher on the average, the whorls are distinctly vaulted, and the lip is widely expanded and white. The color of the shell is yellow-greenish, on the apex whitish yellow, in contrast with the typical *P. meta* which has a different coloration, slightly vaulted whorls, and a weakly expanded dark red-brown lip. But in a series at the Museum of Berlin from Ysabel Island an intermediate specimen exists that has the clear color and the white lip of the typical *P. acmella*, but the lip is not so widely expanded and the whorls

are flat, as in the typical *P. meta*. In the collection of the Museum of Berlin there are also one similar intermediate shell from Bougainville and two intermediate specimens with the general locality Solomon Islands.

The typical *acmella* specimens are known from Bougainville, Ysabel Island (Brazier, 1880), Faro and Florida Islands (Smith, 1885), and now, collected by the Whitney South Sea Expedition, from Choiseul. The locality "Admiralty Islands" is erroneous. The typical *meta* lives on Ysabel Island [also *P. deidamia* (Angas) as a synonym] and on Bougainville. As the distribution of both "species" shows, it is thus impossible to treat them as geographical races.

*P. miser* (Cox) and *P. beatrix* (Angas), a synonym of *P. miser*, were described with the general locality Solomon Islands. The specimens before me called *P. miser* [four specimens from the collection of the Museum of Leiden and three from the collection of the Museum of Berlin (examples obtained by Fulton)] were found on Florida Island. The four specimens from the collection of Leiden resemble in form and color the specimens of *P. beatrix* that Angas figured (*op. cit.*). Only on his figure 5 the colors are weaker. They have small form and flat whorls like *P. meta*. Instead of the chalk-white band below the suture, one specimen has a brown band like that shown in figure 1. The other shells are unbanded. The eight specimens collected by the Whitney South Sea Expedition and three other specimens from the collection of Fulton from Florida Island are relatively larger than those of the Leiden Museum from Florida Island. They have the dimensions and some of them the vaulted whorls of *P. acmella*, but the chalk-white band of *P. meta*. Three of these shells also have a dark lip like that of *P. meta*, and the others have a white lip. Their variability shows that there are intermediate forms between *P. miser*, *P. meta*, and *P. acmella*, and I believe that all these forms are identical. Larger series would probably show that *P. miser* is a geographical race on Florida Island. This is contrary to Kobelt's<sup>1</sup> opinion that the yellow-colored smaller specimens with the flat whorls may represent still another species. *P. adonis* (Angas), having a different color and being acutely carinated, has nothing to do with the last mentioned form.

*Meta* type, altitude, 23.9–28 mm., diameter, 18.7–21.1 mm.; *acmella* type, Ysabel Island, altitude, 27.8–29.7 mm., diameter 19.9–24 mm.; *acmella* type, Choiseul Island, altitude, 27.6–29.8 mm., diameter, 21.5–24.7 mm.; *acmella* type, Bougainville, altitude, 29.6–32.6 mm., diameter;

<sup>1</sup>1897, 'Conchyl. Cabinet Martini u. Chemnitz,' I, part 12, Helicorum, IV, p. 589.

23.4–24.2 mm.; Florida Island, altitude, 25.8–30.8 mm., diameter, 19.7–23.1 mm. The specimens from Bougainville (I could measure only four shells) are relatively larger than those from Ysabel and Choiseul Islands. The specimens (*meta* type) from Ysabel Island are lower.

The Whitney Expedition also collected two not completely adult shells on Bougainville (at Kieta), which are somewhat different. They have the general form of *P. meta*, but a dark brown band on the blunt carina which is not known in *P. meta*. Above and below the peripheral brown band there are chalk-white bands, of which the lower one is the broader. The incompletely finished lip is white-gray and has a little notch on the columella. But this material is too poor to be named.

***Papuina plagiostoma plagiostoma* (Pfeiffer)**

*Helix plagiostoma* PFEIFFER, 1856, Proc. Zool. Soc. London, p. 381.

*Papuina fulacorensis* CLAPP, 1923, Bull. Mus. Comp. Zool., LXV, p. 389.

TYPE LOCALITY.—(Erroneously, Admiralty Islands) Solomon Islands.

The comparison shows that *P. plagiostoma* (Pfeiffer) and *P. fulacorensis* Clapp are identical. Of both species the form is generally the same. The upper whorls and the lip of *P. plagiostoma* should be dark pink, according to Pilsbry (*op. cit.*, p. 19). I can see it so only in one specimen before me. In the other specimens these parts vary in color from horn-color to white. On the paratype of *P. fulacorensis* the pink color is also slightly visible. Nearly all specimens show a more or less marked small chalk-white band below the carina. Clapp mentions the same of *P. fulacorensis*. The specimens are "unbanded, or with from one to three narrow, opaque, yellow bands, one slightly below the suture, one just above, another just below the peripheral carina."

In the description of *P. plagiostoma*, Pfeiffer gives a small altitude and a large diameter (altitude, 21; diameter 23.5 mm.) but Pilsbry gives an altitude of 26–26.5 mm. and a diameter of 21–22 mm. Clapp's *P. fulacorensis* has an altitude of 28.5 mm. and a diameter of 22.5 mm. A paratype of *P. fulacorensis* before me has an altitude of 26.6 mm. and a diameter of 22.6 mm. The shell from the collection of the Museum of Leiden measures: altitude, 27 mm., diameter, 23.3 mm.; and a specimen from the collection of the Museum of Berlin: altitude, 26.3 mm., diameter, 22.2 mm. I believe that Pfeiffer was incorrect in regard to his measurements, for in all the specimens mentioned the altitude is greater than the diameter.

Clapp figures (Fig. 32) the types of the teeth from the middle of the radula of *P. fulacorensis*.

The original locality of *P. plagiostoma*, "Admiralty Island," which Pfeiffer gives, is an error, as Pilsbry also thinks. One of the Solomon Islands must therefore be taken as type locality. The type locality of *P. fulacorensis* is Ysabel Island. Two specimens, from the collection of Leiden, were found on the same island. This also confirms the identity of the two forms. C. R. Boettger<sup>1</sup> mentions the island of Buka as habitat of *P. plagiostoma*.

***Papuina plagiostoma bougainvilliana*, new race**

TYPE LOCALITY.—Bougainville.

MATERIAL.—Four specimens, Bougainville (Harana), from the collection of the British Museum (Natural History), London; two specimens, Bougainville, collected by the Whitney South Sea Expedition.

DIAGNOSIS.—Four specimens from the collection of the British Museum, from Harana on Bougainville, are distinguished from *P. plagiostoma* Pfeiffer in having a slenderer form. The specimens have 6 or 7 whorls (*P. plagiostoma* has only  $5\frac{1}{2}$  or 6) and possess, like the typical race, only a half-covered umbilicus into which it is possible to look. They are quite different from *P. adonis* (Angas) and resemble this species only in the slender form. *P. adonis* has a totally covered umbilicus and a slightly expanded columella, whereas *P. plagiostoma* and its race have a broadly expanded columella. The columella of *P. adonis* forms an edge with the upper margin of the aperture, but in *P. plagiostoma* and its race this part is rounded. The specimens from Bougainville have a chalk-white band below the carina (on one shell also above the carina) and another band below the suture. Clapp's description of the bands of *P. fulacorensis* (see also *P. plagiostoma*) shows exactly the same markings. The lip is weakly expanded and horn-colored as in *P. adonis*. All the four specimens of the race are of a particularly even transparent horn color. They have a dull surface in contrast to the typical form, which is polished.

Altitude, 24.1, 25.8, 26, 27 mm.; diameter, 19.5, 19.6, 19.4, 21 mm.

I place two injured and decayed specimens collected by the Whitney Expedition on Bougainville with this race *bougainvilliana* because of the conformity of the shape, though the coloring is different. The specimens are of indistinctly dark brown-red color. The chalk-white band is found only below the carina and is lacking below the suture. The specimens are generally more solid and larger. The one nearly adult shell has  $6\frac{1}{2}$  whorls.

Type in the British Museum (Natural History), London (altitude, 26 mm.).

<sup>1</sup>1918, Abhandlungen Senck. Nat. Ges., XXXVI, p. 291.

**Papuina mendoza** (Brazier)

*Helix* (*Geotrochus*) *mendoza* BRAZIER, 1872, Proc. Zool. Soc. London, p. 21, Pl. iv, fig. 8.

TYPE LOCALITY.—Choiseul Island, Solomon Islands.

MATERIAL.—One specimen, Wurulata River; one specimen, headlands of Wurulata River, Choiseul Island.

The two specimens before me can not be distinguished from the figure and the description of Brazier. *P. mendoza* differs distinctly from *P. adonis* Angas. The apex is more pointed, the whorls and the lower side of the shell are flatter, and especially, the carina is somewhat compressed and very acute. *P. adonis* is not so sharply carinated. The aperture, also, has a different form. The spire of *P. adonis* forms a sharp edge with the basal part of the aperture, but in *P. mendoza* this part is rounded; on the other side in *P. mendoza* the barely expanded upper part of the aperture forms an edge with the basal part. *P. adonis* has this part rounded.

Altitude, 24, 24.3 mm.; diameter, 20, 18 mm.

DISTRIBUTION.—Choiseul Island.

**Papuina hermione** (Angas)

*Helix hermione* ANGAS, 1869, Proc. Zool. Soc. London, p. 625, Pl. XLVIII, fig. 5.

TYPE LOCALITY.—Bougainville.

MATERIAL.—One specimen, Bougainville (Kieta).

This one specimen is typically shaped and colored.

Altitude, 22.8 mm.; diameter, 18.7 mm.

**Papuina mayri**, new species

Figures 6a, 6b

MATERIAL.—Nineteen specimens, Choiseul Island, Solomon Islands.

DIAGNOSIS.—Shell with covered umbilicus, elevated trochiform, apex pointed, 5½ of 6 vaulted whorls, the last whorl descending little or not at all in front, periphery bluntly angular, becoming rounded toward the aperture; color greenish yellow to grayish yellow, becoming whitish toward the apex, with a red-brown peripheral band nearly ½ mm. in width running in the suture on the upper whorls, which is more deeply colored near the apex, frequently becoming violaceous. On the last whorl some specimens show, more or less distinctly below the dark-colored suture, a broad chalk-white band nearly 1 mm. in width. Aperture roundly quadrangular oblique, interior of the aperture and the expanded lip white. Columella nearly vertical. Surface polished with fine growth wrinkles and very fine microscopic spiral striae on the early whorls.

Altitude 22.3–25 mm., average, 24 mm.; diameter, 20.4–22 mm., average, 21.1 mm.



This species appears to be closely related to *P. meta* (Pfeiffer), but differs in being more depressed trochiform, in having narrower whorls, a relatively greater diameter, and a small red-brown peripheral band. The ground color and also the white lip resemble *P. meta* (variety *acmella*). Like the black-lipped *P. meta*, *P. mayri* has a chalk-white band below the dark red-brown suture. But *P. meta* has this band sharply limited and brightly white in contrast to *P. mayri*. The form of the aperture and the umbilicus are not constantly different.

Type in The American Museum of Natural History (Cat. No. 62470, altitude, 23.2; diameter, 20.4 mm.).

***Papuina motacilla* (Pfeiffer)**

Figure 2

*Helix motacilla* PFEIFFER, 1855, Proc. Zool. Soc. London, p. 113.

*Helix lienardiana* CROSSE, 1864, Jour. de Conchyl., p. 282, Pl. I, fig. 1; 1866, idem, p. 53.

TYPE LOCALITY.—Eddystone Island, Solomon Islands.

MATERIAL.—Fourteen specimens, Malaita (Suu, eleven; Kwarambara, two; Olimburi, one); two specimens, Choiseul Island.

The specimens from the island of Malaita differ from the *P. motacilla* Pfeiffer that I have before me from New Georgia, Simbo Island (Smith, 1885), and Guadalcanar [see Dr. E. Paravicini (Basel)], in having  $4\frac{1}{4}$  to  $4\frac{1}{2}$  whorls instead of  $4\frac{1}{2}$  to 5 as in *P. motacilla*. The carina is not generally so sharp and the whorls on the upper side are more convex. The shells from Malaita also are less in altitude and all have two dark chestnut bands separated by a white peripheral zone. But the bands of all the other specimens of *P. motacilla* are variable. There are shells with small brown bands and others with whitish-brown bands and a white peripheral zone, as on the typical *P. motacilla*, and a few specimens with broad dark chestnut bands. Clapp mentions (*op. cit.*, p. 394) *P. lienardiana* (= *P. motacilla*) from the island of Malaita. He remarks that the specimen from Auki has two broad chestnut bands with a white peripheral zone and that the bands are much broader than those in the specimens figured by Crosse. All specimens from Malaita correspond in this character. It is also remarkable that the margins of the aperture of the specimens from Malaita are not completely white, as in the typical *P. motacilla*, for the bands also color the margins.

It seems possible to base a geographical race on these specimens from Malaita, but unfortunately a series of *P. motacilla* with exact localities is not available to justify establishing it.

The two specimens collected by the Whitney Expedition on Choiseul do not differ from the shells of Malaita. I believe that *P. motacilla* is not known from Ysabel Island.

Altitude, 14.1–16.1 mm., average, 15 mm.; diameter, 18.5–20.3 mm., average, 19.3 mm.

Clapp figures the radula of one specimen also collected on Malaita. The radula that I prepared corresponds to this figure, but the basal plate of the central tooth shows three little points (Fig. 3). These same points are to be seen on the radula of *P. maddoxi* (Brazier), which Clapp figures. Perhaps these points characterize a special group of *Papuina*.

Pfeiffer, 1855, described *P. motacilla* with white-brown bands and a peripheral white zone. Crosse, 1864, described *P. lienardiana* with brown bands. All the other characters of the two "species" correspond. In a series before me from New Georgia there are specimens like the typical *P. lienardiana* and some like the typical *P. motacilla*, but also shells with the characters of both "species." For example, one shell has above a whitish brown band like *P. motacilla* and below a dark band like *P. lienardiana*.

Perhaps *P. sachalensis* (Pfeiffer) is also a synonym of *P. motacilla*. The similar *P. gelata* (Cox) and *P. eddystonensis* (Reeve) are well distinguished by the stronger margins of the columella.

#### ***Papuina eros* (Angas)**

*Helix leucothoë* PFEIFFER, 1861, Proc. Zool. Soc. London, p. 192.

*Geotrochus eros* ANGAS, 1867, Proc. Zool. Soc. London, p. 888, Pl. XLIII, figs. 4–6.

TYPE LOCALITY.—Stephen Island, Ysabel Island, Solomon Islands.

MATERIAL.—Forty specimens, Choiseul Island (Choiseul Bay, ten; Poro, two; Bambatani, eight; Tauro, thirteen; Wurulata River, five; Lumbee, two). One specimen, Faisi (Shortland Island).

Up to date, *Papuina eros* is known from Stephen Island, Ysabel Island (Clapp, *op. cit.*, p. 395), Shortland Island (Smith, 1885), and from Buka Island (C. R. Boettger, *op. cit.*, p. 294). The Whitney South Sea Expedition found *P. eros* for the first time on Choiseul Island and one shell on Bougainville [two other specimens, see Dr. Hediger (Basel)]. *P. eros* is most variable in dimensions and color, but the form is constant and very well distinguished from those species that have another design. The nearly flat whorls and especially the last whorl increase in size more rapidly. Similar species, such as *P. sachalensis* (Pfeiffer) and *P. eddystonensis* (Reeve) have a more impressed suture and therefore more convex whorls. Most of the shells have the umbilicus nearly covered by the

columella, but some other specimens are scarcely or at best half covered. *P. eros* possesses a little flattened lip which is very often pink in color.

I believe that *Papuina leucothoë* (Pfeiffer) is a synonym of *P. eros*. The specimens in this lot do not differ much from the figure in Pfeiffer's description nor from the specimens of *P. leucothoë* from the collection of the Museum of Berlin. Especially the form and the pink-colored lip are the same. Color and pattern are different. The specimens have a yellowish ground color, without bands, or with one or several more or less broad chestnut-colored bands, or with an irregular zigzag band. The apex varies in color from pink to dark violaceous, but several specimens have the apex uncolored.

The dimensions are extremely variable. The altitudes range from 11.5 to 15 mm., and the diameter from 14.5 to 19.5 mm. The typical dimensions of *P. eros* (after Tryon and Pilsbry, *op. cit.*, p. 70) are: altitude, 14 mm., diameter, 18 mm.; of *P. leucothoë*, altitude, 12.5 mm.; diameter, 20.5 mm. Two specimens from Shortland Island, from the collection of the Museum of Leiden, have an altitude of 14.5–15 mm., and a diameter of 19.7–20.3 mm. It is remarkable that *P. leucothoë*, with such a large diameter, has such a small altitude.

Clapp figured the radula and the reproductive organs of *P. eros*.

### ***Papuina eyerdami*, new species**

Figures 7a, 7b

**MATERIAL.**—One specimen, Choiseul Island (Puti), Solomon Islands.

**DIAGNOSIS.**—Shell globose trochiform, nearly bulblike; apex acute, umbilicus slightly covered; five carinated, vaulted whorls, the last descending but little; aperture rounded, lip expanded, rose-colored, columella relatively broad. The last whorls above and below dark brown with a shine of violaceous gray, the upper whorls lighter brown; directly below and above the keel is a whitish band 1 mm. broad, and the same below the suture; surface with growth wrinkles that are so strongly formed that they interrupt the keel and form knots (especially near the aperture); on the upper whorls fine spiral striae.

Altitude, 19 mm.; diameter, 21 mm.

Perhaps *Papuina caerulescens* (Angas) is most similar to the new species. *P. eyerdami* differs from it in being more rounded trochiform, nearly bulblike (caused by the vaulted last whorl), in having a very pointed protoconch and an open umbilicus. Besides, the last whorl is only slightly descending, in contrast to *P. caerulescens*. The proportion of diameter to altitude is the same in both species.

Type in The American Museum of Natural History (Cat. No. 62469).

**Papuina (Crystallopsis) gowerensis fictilia** (Clapp)

*Crystallopsis fictilia* CLAPP, 1923, Bull. Mus. Comp. Zool., LXV, p. 397, Pl. iv, figs. 1-3.

TYPE LOCALITY.—Malaita (Auki), Solomon Islands.

MATERIAL.—Fourteen specimens, Malaita (Auki).

The Whitney Expedition, and also Dr. E. Paravicini (Basel), found *Papuina gowerensis fictilia* on Malaita. The specimens generally resemble the paratype before me. The differences that Clapp described between *P. fictilia* and *P. lactiflua* (Pfeiffer) are represented only in a part of the series before me. On the average, the specimens of *P. g. fictilia* are more globose, but there are also a few shells that have an elevated apex and therefore resemble *P. lactiflua*. Looking from below into the shell, each species shows a different position of the columella. The first part of the columella of *P. lactiflua* seems to be vertical, but when looking into the aperture one can see that it is curved from back to front. In contrast to this, the columella of *P. g. fictilia* runs down obliquely sideways almost from the beginning. This difference is quite constant. The periphery is not always rounded. One shell from Auki has the periphery carinated like *P. lactiflua*. Contrary to the statement of Clapp, the suture is not less deeply impressed than in *P. lactiflua*. Some shells of *P. g. fictilia* before me have the suture even more deeply impressed and the whorls are more vaulted. Three specimens from Auki and one specimen from Buma have the white band on the periphery like *P. lactiflua*.

Altitude, 16.8–19.8 mm., average, 18.5 mm.; diameter, 23.5–27.2 mm., average, 24.9 mm. Clapp describes an altitude of 20 mm., but not one shell before me has this measure, moreover the three paratypes are smaller. The diameter also differs.

Clapp did not examine the radula and the genital system. From a shell collected by the Whitney Expedition I was able to prepare a radula. It has the normal *Papuina* type of V-shaped tooth rows. The central tooth is formed like a spatula with a curved cutting edge. The following 86–88 teeth on each side (middle part of the radula) have a large mesoconus and a little entoconus, and on the 5–6 tooth there still appears an ectoconus. Clapp figures the radula of *Crystallopsis fulacorensis* (*op. cit.*, Fig. 38); it resembles the radula of *P. g. fictilia* except that the central tooth has a more curved cutting edge. The ectoconus and the entoconus of the outermost two or three teeth of each row are bicuspid.

C. R. Boettger (*op. cit.*, p. 294) described *Papuina gowerensis* from Gower Island, north of Malaita. The paratype before me shows scarcely

any difference from *P. g. fictilia*. Therefore I believe that the two species belong to a "Rassenkreis," *P. g. gowerensis* is distinguished from *P. g. fictilia* only by the dimensions. C. R. Boettger published an altitude of 16 mm. and a diameter of 21 mm., but the paratype before me has an altitude of 17 mm. and a diameter of 23.1 mm. The average measurements of *P. fictilia* are: altitude, 18.5 mm.; diameter, 24.9 mm.

***Papuina (Crystallopsis) paravicinii* I. Rensch**

*Papuina (Crystallopsis) paravicinii* I. RENSCH, 1933, Zool. Anz., CII, p. 317, fig. 5.

TYPE LOCALITY.—Malaita (Buma), Solomon Islands.

MATERIAL.—Fourteen specimens, Malaita (Suu).

The fourteen specimens collected by the Whitney Expedition near Suu, Malaita, are entirely distinct from the specimens that Dr. E. Paravicini found in Buma, Auki, and Maka (Malaita). The specimens from Suu possess small or broad indistinct chalk-white bands above and below. The aperture is more rounded and, on the average, larger than in the typical *P. paravicinii*. The lip is remarkably more expanded. These characteristics are to be observed constantly in all specimens from Suu. I surely believe that the series from Suu represents a geographical race distinct from the series from Buma and Auki. At Maka, south of Suu, Paravicini collected two specimens that resemble in general form the typical *P. paravicinii*, but with their large rounded aperture corresponding to the specimens from Suu. Perhaps they represent another race. But I will not name these races, because their limits are still indistinct.

Altitude, 14.2–17.8 mm., average, 15.8 mm.; diameter, 23–26.9 mm., average, 24.9 mm.

The radula and the genital system were described in the diagnosis of *P. paravicinii*.

**"Rassenkreis" of *Dendrotrochus helicinioides***

As I have mentioned in the introduction, I would group the following species in a "Rassenkreis": *Dendrotrochus helicinioides* (Hombron and Jacquinet), *D. cleryi* (Reclus), *D. cineraceus* (Hombron and Jacquinet), *D. mentum* Hedley, *D. krämeri* Thiele, *D. flaris* Leschke, *D. labillardieri* Smith. I was able to study a very large amount of material (1160 specimens). As the Whitney Expedition collected a rather large series of *Dendrotrochus* on the Solomon Islands, I shall first examine these forms and discuss their synonymy.

Clapp, in his work (*op. cit.*, p. 375), published the list of the synonyms of *D. helicinoides*: *D. cineraceus*, *D. cleryi*, *Helix cyrene* Crosse, *H. quirosi* Cox, *H. zelina* Cox, etc. *Helix cineraceus* was described by Hombron and Jacquinot, 1841, in *Ann. sci. nat. de Paris*, p. 64. Plate VII in the volume of the 'Voyage au Pol Sud' (published about 1852) represents the figures of *D. helicinoides* and *D. cineraceus* and clearly shows the differences. *D. cineraceus* is more roundish, the whorls are more vaulted, and the aperture especially is more rounded. Series from Choiseul and Shortland Island, collected by the Whitney Expedition, show more or less distinctly these characters of *D. cineraceus* (= *D. cleryi* variety *septentrionalis* Smith, 1885, *Proc. Zool. Soc. London*, p. 593). At all events, the differences between these series of "*cineraceus*" are very pronounced in comparison with the specimens from San Cristobal, Ugi, St. Anna, Ulawa Islands (collection of Fulton). The large series that Dr. E. Paravicini (Basel) collected on San Cristobal (one of them contained 169 shells) shows the brown-banded type of *D. cleryi* (Reclus) [= *D. cleryi* variety *meridionalis* Smith, = *D. cyrene* Crosse from Ugi Island (the brown band is transparent)]. These forms are more conical, the whorls a little bit flatter, the upper part of the last whorl is flat in contrast to *D. cineraceus*, which has the upper part distinctly vaulted. Also the lip is a bit more expanded. The only unbanded specimens before me similar to the typical *D. helicinoides*, figured on Pl. VII, figs. 34-37 of Hombron and Jacquinot, are from Hammond Island. The type locality of this form must be St. George or Ysabel Island, which were the only islands visited by the 'Astrolabe' and the 'Zelle' (to which fact Dr. Mayr kindly called my attention). But I have no material from Ysabel Island before me.

The specimens from New Georgia, Simbo (*D. cleryi* var. *simboana* Smith), Guadalcanar, Malaita, Ysabel Island (Clapp, *op. cit.*, p. 322, Buka) are not clearly distinguishable. The series from these islands which I have before me shows that the specimens are smaller on the average and that the bands, if present, are not so sharply defined.

The other synonym, *H. quirosi* Cox, is not figured and no exact locality is published. Cox mentions the resemblance to *D. cleryi*. He writes: "This species would be like a magnified specimen of *C. cleryi* Reclus were it not wholly unornamented, much more broadly expanded and less conical." But the type is in the Sydney Museum and the comparison is not possible.

In my opinion, *Helix zelina* Cox is not a synonym of *D. helicinoides*.

*H. zelina* has 7 whorls, *D. helicinoides* only 5½. Also the figure given by Cox shows that *zelina* is another species.

All specimens of the whole "Rassenkreis" before me have a lattice sculpture on the embryonal whorls. The other whorls and the upper side possess a very fine and minute spiral sculpture. It is most interesting and important that banded and unbanded shells of *D. mentum* Hedley from New Britain (= Neu-Pommern) have a strong spiral sculpture. Specimens from Tabar and Mahur (east of New Ireland = Neu Mecklenburg) have the fine wavy spiral sculpture both above and below, like the shells of the Solomon Islands.

The dimensions of the various forms from the Solomon Islands are rather different:

San Cristobal—altitude, 9.8–13.7 mm., diameter, 13.8–19 mm.

St. Anna—altitude, 9–11.1 mm., diameter, 14.1–17.3 mm.

Ulawu Island, three specimens—altitude, 11.7–12.4 mm., diameter, 19.6–20.7 mm.

Choiseul Island—Altitude, 9.5–12.1 mm., diameter, 13.1–16.7 mm.

Hammond Island, two specimens—altitude, 13.2–14 mm., diameter, 14.6–16.4 mm.

Malaita—altitude, 9.5–10.7 mm., diameter, 13.2–16.7 mm.

Guadalcanar—altitude, 9.7–12.3 mm., diameter, 12.6–17.8 mm.

New Georgia—altitude, 8.1–10.7 mm., diameter, 12.5–14.7 mm.

Buka—altitude, 9.8–11 mm., diameter, 13.3–15 mm.

Ysabel Island (Clapp)—altitude, 10.7 mm., diameter, 15.4 mm.

Type of *D. helicinoides*—altitude, 10 mm., diameter, 16 mm.

As these measurements show, the rounded shells from Choiseul (*D. h. cineraceus*) do not attain the largest diameter of the *cleryi* shells. The specimens from Buka (there are only three measurable specimens before me) resemble in dimensions the specimens from Choiseul. The specimens from New Georgia average smaller.

Hedley, 1895, published (Rec. Austr. Mus., p. 90, Pl. XXI) a description and figure of the anatomy of *Dendrotrachus "helicinoides"* without exact locality. Specimens that I examined from New Britain resemble in general Hedley's figure. They vary in the form of the duct of the spermatheca. This can be long and slender with a globose bursa, but the duct can also be swollen and big and then the bursa is not so much differentiated as Hedley's figure shows. Two specimens in alcohol from Choiseul and Guadalcanar have a long slender duct. *D. filaris* Leschke, which I was able to examine, from Lambussu and St. Matthias, collected by Dr. A. Bühler (Basel), shows the same. All specimens examined anatomically have a liver-colored gland-ring around the uterus (see the description of Hedley; he writes, "The base of the vagina is black").

It is most important and interesting that in this "Rassenkreis" there also exist anatomical differences in the radula. There are two distinct types of radula: the first is represented by the typical race *D. helicinoides cineraceus* from Choiseul, by the intermediate form from Guadalcanar (Fig. 3), and by the races *D. h. labillardieri*, *filaris*, *krämeri* (Fig. 4), and *intercalata* (compare the classification at the end of this paper); the second type is represented by the race *D. h. mentum* (Fig. 5). The first type has a more or less pointed central tooth, whereas the central tooth of *D. h. mentum* is rounded, with a little point on the middle of the cutting edge. The outer teeth of all races are bifid and very finely

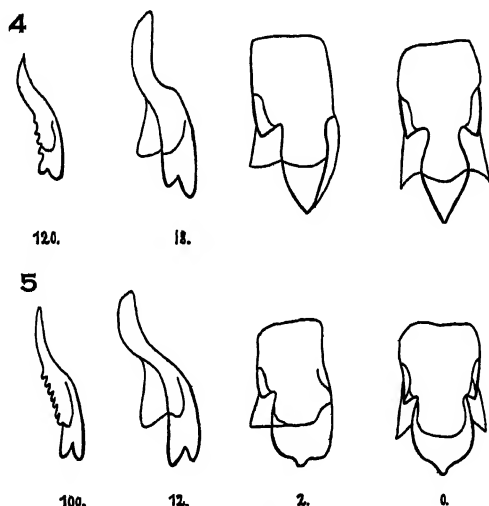


Fig. 4. Radula teeth of *Dendrotrochus helicinoides krämeri* Thiele.

Fig. 5. Radula teeth of *Dendrotrochus helicinoides mentum* Hedley.

serrated on the outside of the tooth. The outer cusp of the tooth of the specimens from New Britain is nearly always larger than the inner cusp of the tooth, in contrast to all the other races, which have a larger inner cusp. The number of teeth in half a row (nearly in the middle part of the radula) varies:

<i>D. helicinoides cineraceus</i>	M—(12-13)—(137-139)
<i>D. helicinoides mentum</i>	M—( 9-10)—(110-115)
<i>D. helicinoides filaris</i>	M—(13-14)—(ca. 178)
<i>D. helicinoides krämeri</i>	M—(12-15)—(128-132)

The following list gives a detailed classification of the "Rassenkreis" of *Dendrotrochus helicinoides* based on the extensive material before me:



I.—*D. h. helicinoides* (Hombron and Jacquinot) (Fig. 8). Whitish gray to horn-yellow gray, without bands, trochiform, aperture flat, minute spiral sculpture above and below. Hammond Island. Type locality, St. George or Ysabel Island.

II.—*D. h. cineraceus* (Hombron and Jacquinot) (Figure 9). Horn to dark horn-color, without bands, globose trochiform, aperture rounded, with minute spiral sculpture. The central tooth of the radula not so sharply pointed. Choiseul and Shortland Island. (Hombron and Jacquinot gave: "New Guinea.")

III.—*D. h. cleryi* (Reclus) (Fig. 10). Same ground color as *D. h. helicinoides*, with various broad brown bands, trochiform, aperture flat, minute spiral sculpture above and below, diameter on the average larger than in the typical race. San Cristobal, St. Anna, Ugi, Ulawa, Bio Island. (Reclus gave only "Solomon Islands.")

IV.—*D. h. mentum* Hedley (= *D. acutistriatus* Leschke and *D. dahli* Thiele). Unicolored whitish to horn-colored, or with various broad brown bands, trochiform, aperture flat, with a strong spiral sculpture above and below, but there are also specimens without sculpture, dimensions smaller than in the typical race (altitude, 7.3–11.8 mm.; diameter, 9.8–15.9 mm.). The central tooth of the radula rounded with a little point on the middle of the cutting edge. Individual variability: (1) a ridge on the last whorl behind the lip, only 17.7 per cent of the 321 specimens lack this ridge (Fig. 11); (2) some specimens are strongly ribbed (*acutistriatus*) (Fig. 12). New Britain (Neu-Pommern).

V.—*D. h. krämeri* Thiele<sup>1</sup> (Fig. 13) (= *D. pumila* Fulton from New Ireland?). Ground color whitish, brown banded, relatively elevated, trochiform, aperture flat, minute spiral sculpture above and below, relatively great altitude (altitude 9.8 mm.; diameter, 12.4 mm.). The central tooth of the radula pointed. New Ireland (Neu Mecklenburg).

VI.—*D. h. intercalata*, new race (Fig. 14). Ground color whitish gray with various broad brown bands, trochiform, aperture flat, similar to *D. h. cleryi* but the upper side flatter,  $5\frac{1}{2}$  to 6 whorls, with a minute spiral sculpture above and below. In contrast to *D. h. cleryi* the shells are relatively flatter (altitude, 9–10.6 mm.; diameter, 14.1–16.1 mm.). The central tooth of the radula is pointed. TYPE No. 6029, Senck-

Fig. 6 a, b. The type of *Papuina mayri*, new species, Natural size.

Fig. 7 a, b. The type of *Papuina eyerdami*, new species. Natural size.

Fig. 8. *Dendrotrochus h. helicinoides* (Hombron and Jacquinot) from Hammond Island.  $\times 2$ .

Fig. 9. *Dendrotrochus helicinoides cineraceus* (Hombron and Jacquinot) from Choiseul Island.  $\times 2$ .

Fig. 10. *Dendrotrochus helicinoides cleryi* (Reclus) from San Cristobal.  $\times 2$ .

Fig. 11. *Dendrotrochus helicinoides mentum* Hedley from New Britain.  $\times 2$ .

Fig. 12. *Dendrotrochus helicinoides mentum* Hedley (*acutistriatus* Leschke) from New Britain.  $\times 2$ .

Fig. 13. *Dendrotrochus helicinoides krämeri* Thiele from New Ireland.  $\times 2$ .

Fig. 14. *Dendrotrochus helicinoides intercalata*, new race, from Mahur.  $\times 2$ .

Fig. 15. *Dendrotrochus helicinoides filaris* Leschke from St. Matthias.  $\times 2$ .

Fig. 16. *Dendrotrochus helicinoides labillardieri* Smith from Admiralty Island.  $\times 2$ .



enberg. naturf. Gesell., from Mahur, a small island east of New Ireland (altitude, 10 mm.; diameter, 15.7 mm.). The specimens were kindly lent me from the collection of the Senckenberg Museum by Dr. F. Haas. Mahur, Tabar.

VII.—*D. h. filaris* Leschke,<sup>1</sup> (Fig. 15) (= *D. trochoidalis* Leschke, = *D. vicarius* C. R. Boetger). Unbanded whitish yellow or pink to dark violaceous, very often with a small dark violaceous band on the carina and on the suture. The apex also is often dark violaceous, elevated trochiform, whorls and upper side flat, aperture flat, lip weakly expanded, below and above a very minute spiral sculpture (altitude, 9.1–10.6 mm., diameter, 13.4–17.8 mm.; the smallest specimen of *D. filaris* Leschke, altitude, 8.4 mm.; the largest specimen of *D. vicarius* C. R. Boettger, altitude, 11 mm.). The central tooth of the radula not so sharply pointed. St. Matthias, Squally Island.

VIII.—*D. h. labillardieri* E. A. Smith<sup>2</sup> (Fig. 16). Unbanded, whitish gray or pink to dark violaceous, depressed globosely trochiform, whorls and upper side vaulted, aperture flat, lip very broadly expanded, apex always dark violaceous, with minute spiral sculpture above and below (altitude, 9.5–12 mm., diameter, 13–17 mm.). The central tooth of the radula a little rounded. Admiralty Islands.

<sup>1</sup>1911–1912, Mitt. Nat. Mus. Hamburg, XXIX, p. 96, figs. 3, 3a.

<sup>2</sup>1884, Proc. Zool. Soc. London, p. 264, Pl. xxxi, figs. 3, 3a.

